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**TRANSLATION OF SELECTED PORTIONS
OF POLYGRAPH COURSE OF THE JAPANESE
JURISPRUDENCE SCIENCE TRAINING CENTER**

**A Report Prepared under an Interagency Agreement
by the Federal Research Division,
Library of Congress**

August 1994

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PREFACE

This product provides a full English translation of selected portions of a study guide on the history, construction, and operation of polygraphs developed by the Jurisprudence Science Training Center of the National Police Agency of Japan. Sample cases and labeled diagrams are included to illustrate practical use of the instruments.

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1. Introduction to Polygraph Tests

1.1 Outline of Polygraph Testing

In polygraph tests, questions are presented to examinees according to a set procedure: Physiological responses that appear in response to each question are measured and recorded using polygraph equipment. Test results are called the test record (or chart). Examiners compare the physiological responses recorded visually and evaluate emotional changes that occur in response to each question.

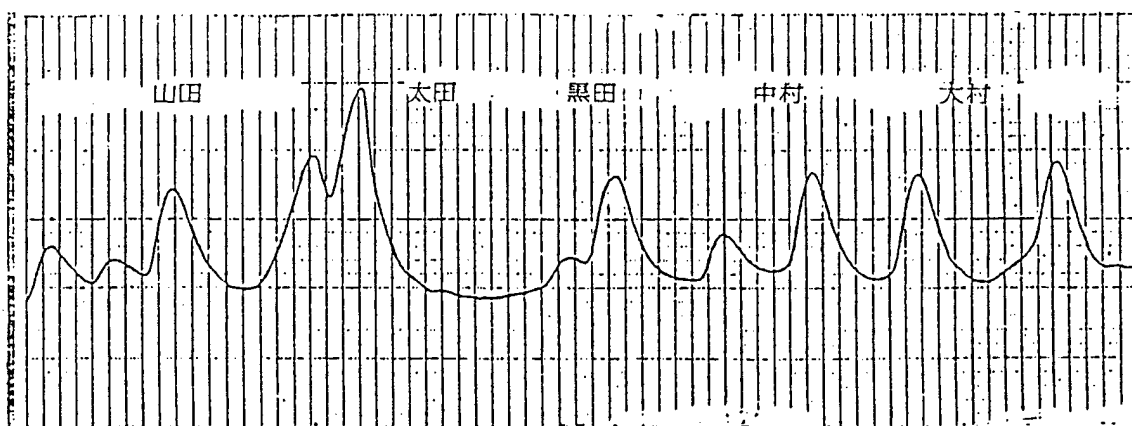
Above is a summary of polygraph testing. However, detailed explanations are provided below for gaining comprehensive understanding, since the summary alone is not sufficient for this purpose.

Polygraph tests are sometimes popularly called "lie detection tests." This popular name is certainly a handy one for easy understanding of the function and effects of the test. On the other hand, the name may give the impression that the objective of this test method is to detect "lies." The name may lead to the misunderstanding that when someone taking the test "lies," special physiological responses that signal a "lie" appear and thereupon a "lie" is detected. In reality, however, there exists no special physiological response that in itself detects a "lie." Then, what is found when polygraph test methods are

applied? The following is an experiment introduced to answer this question.

A person appears in front of polygraph equipment to be examined. The most appropriate person for this purpose has no relationship to the examiner. Let us assume it is a male whose name is unknown. The examinee is given paper and a pencil and is asked to write five or six surnames. His own name must be included. He writes five names; Yamada, Ota, Kuroda, Nakamura, and Omura. His name must be one of these, but the examiner, of course, cannot point out which is the right one.

The galvanic skin response (abbreviated as GSR: details about its characteristics will be described later), which is relatively easy to measure, is used as an indicator. Questioning takes the form, "Are you Mr. so and so?" The examinee answer, "No." Therefore, when the question asked happens to be about the examinee's surname, the answer will be "false" while answers to other questions will be true. Figure 1 indicates a part of the GSR record. The height of the curve represents response strength. The examinee answered "No" to question Number 2, "Are you Mr. Ota?" This question elicited the greatest response. As the GSR is a physiological response that reflects changes in emotional sensitivity, it can be determined that the examinee's greatest emotional change has occurred in response to this question. It is obvious when comparing GSR responses to other questions that there are no visible characteristics that suggest qualitative differences among these GSRs.



[Key to Fig. 1: GSR Record (an experiment)]

1. Yamada 2. Ota 3. Kuroda 4. Nakamura 5. Omura]

The conclusion was that this examinee was "Mr Ota." The examinee himself testified to the correctness of this evaluation.

Why did the large GSR that provided the clue for the evaluation appear? The first idea that occurs is that this is a response to an emotional change caused by a "false" answer. As we experience in our daily life, when we assert something untrue, so-called "guilt feelings" obviously evoke an emotional change. However, the "false" answer in this experiment was "false" as determined by the experimental procedure; it did not come from the examinee's own will. That is, "guilt feelings" in this case may not have been so great as to cause a great change in emotion. Rather, the important condition in this experiment may have been the use of the examinee's surname as the content of the question. The question, "Are you Mr. Ota?" must have

given a stronger impression than other questions. It is presumed that the "cognitive" value of this question must have been quite high. "Cognition" in this context means making a stronger and clearer recognition from among plural objects. For example, in a situation of "being the sole red among the green," the red stands out distinctively and can be easily distinguished. Also, all the attention centers on the red. In this way, the act of "cognition," distinguishing a particular object from many others, concentrating attention on it, evokes rather great emotional changes.

1.2 Theoretical Interpretations of the Test

(1) Fear of punishment

"While attempting to hide the truth, one exhibits increased heartbeat, facial flush, or uncontrollable swallowing movements. The cause of these responses is fear that one's lie may be detected." (Inbau, F. E. Lie Detection and Criminal Interrogation, 1948)

This explanation, that "fear of punishment" evokes relatively great physiological responses, is the most popular theoretical interpretation, since it is easy to understand and sounds plausible, as well as being grounded in our daily experiences.

However, many phenomena associated with polygraph testing cannot be completely explained by the above interpretation. For example, one of

the basic theories, "motivation theory" cannot be explained by "fear of punishment" alone.

(2) Conditioned responses

When presented with a question related to the crime, the examinee, if he/she happens to be the offender, will remember the criminal act from the content of the question and relive the strong emotion associated with it. According to this explanation, prominent physiological responses to the question consequently emerge.

This explanation is persuasive with crimes that are accompanied by intense emotion such as murder or sexual crimes. On the other hand, it is hard to explain those crimes that are not accompanied by intense ones, e.g. theft or fraud committed by a habitual criminal.

It is also difficult to explain the display of prominent physiological responses in a card test situation where hardly any emotional involvement is expected; examinees are merely asked to select a card.

(3) Conflict

This theory holds that emotional changes that arise when confronted with a choice between several conflicting acts, such as telling the truth or lying are responsible for the prominent physiological responses.

Even in the absence of fear of punishment, one feels a so-called guilty conscience associated with the lie. This state is considered as representing an internal conflict.

Considerable individual differences exist regarding states of conflict so that the theory has difficulty completely explaining many phenomena associated with polygraph testing.

(4) Level of wakefulness

Level of wakefulness is defined as a continuous change in the relative state of tension during a period between the states of sound sleep and excitement. This continuous change can occur merely with the passage of time, but is also influenced by external stimuli or by internal thought processes.

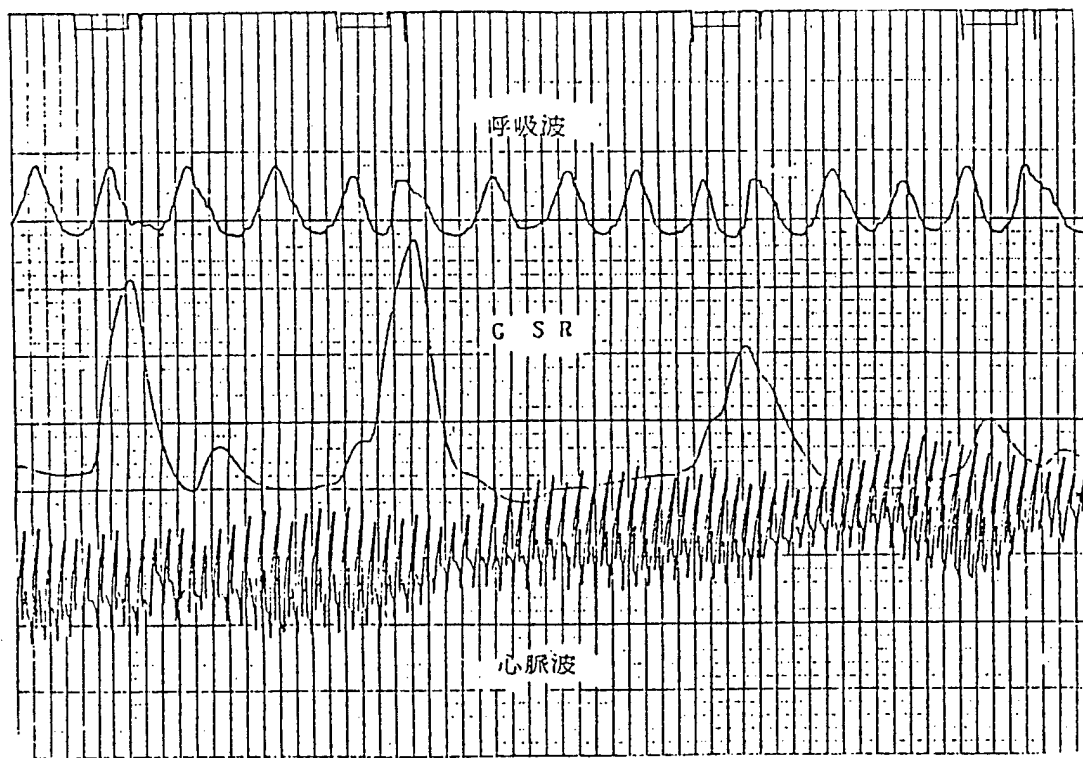
With polygraph tests, many questions are always presented as parallel stimuli. To reach a determination, the relative sizes of the resulting physiological responses are compared. With people who have nothing to do with the crime under investigation, physiological responses to questions with contents that relate to the crime and those that do not will be approximately equal, or, the latter will be relatively larger than the former. In contrast, people who are involved with the crime under investigation show prominent responses to questions that deal with the crime compared to questions set up for the purpose of contrast. This is because these examinees enhance their level of

relative wakefulness when presented with a question that deals with the crime. The psychological mechanism responsible for raising the level of wakefulness is explained by the concept, "degree of ego involvement." Degree of ego involvement indicates the level of relatedness between the self and the object and is expressed as the relative stimulating force that alters the level of wakefulness.

1.3 Polygraph Equipment

At present there are three models of polygraph equipment in use, the TRP-1 model, KT-1 model, and KT-2 model made by Takei Equipment Company. Improvements made on the GSR measurement part (constant current device and time constant) of TRP-1 resulted in the KT-1 model. The KT-2 model is new polygraph equipment that has two respiratory measurement channels as well as an improved device for cardio activity measurement, fingertip plethysmography replacing cardio cuffs.

Figure 2 is a record using the KT-1 model.



[Key to Fig. 2: Test Record Example

1. Respiratory tracing
2. GSR tracing
3. Cardio tracing

1.4 Measurement Indexes

It is general knowledge that various physiological changes reflect changes in human emotion, e.g. changes in complexion, facial expression, heartbeat rhythm, or sweating unrelated to temperature

change. However, not every physiological response is suitable as an index in polygraph testing.

For an appropriate index, the first condition is ease of recording. Suppose we become sick and are hospitalized. We must first be tested for diagnostic purposes. With some tests we must endure considerable hardship such as hunger, thirst, or pain. Patients cooperate positively, because they wish to have the cause of illness found. With polygraph testing, on the other hand, no relationship of positive cooperation such as exists between physicians and patients can be expected. Therefore, it is necessary to select those indexes with which examinee cooperation is easy to obtain. The second condition is that these indexes must sensitively reflect emotional changes. It is also important that the physiological response must change accurately and proportionally to emotional changes. When emotional changes disappear, the index must simultaneously return to its pre-response level.

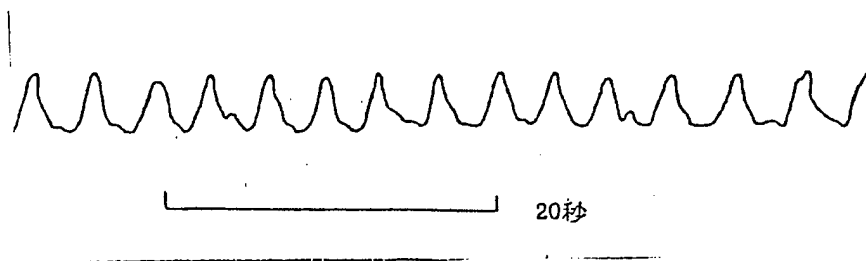
Not too many physiological responses fulfill these conditions. Those that do include responses of the circulatory system, such as heartbeat waves or volumetric pulse waves, respiratory curves and GSR (two types one obtained by endosomatic method, another by exosomatic method; the former is called the skin resistance response, the latter, the skin potential response.)

Polygraph equipment in use at present (TRP-1, KT-1, and KT-2, made by

Takei Equipment Company) measure and record the following three types of physiological responses: Respiratory tracing (breathing curve); galvanic skin response (GSR); and cardio tracing. Each measure will be explained below.

1.4.1 Respiratory Wave

1. Measurement. A rubber tube that holds air is attached to the examinee's chest or the abdomen over the clothing. The expansion and contraction of the rubber tube that accompanies the examinee's respiratory movements is transmitted to a bellows and is recorded by a kymograph. Figure 3 shows respiratory tracings when the examinee is in a calm state.



[Key to Fig. 3: Respiratory Wave Record When the Examinee Is In a Calm State

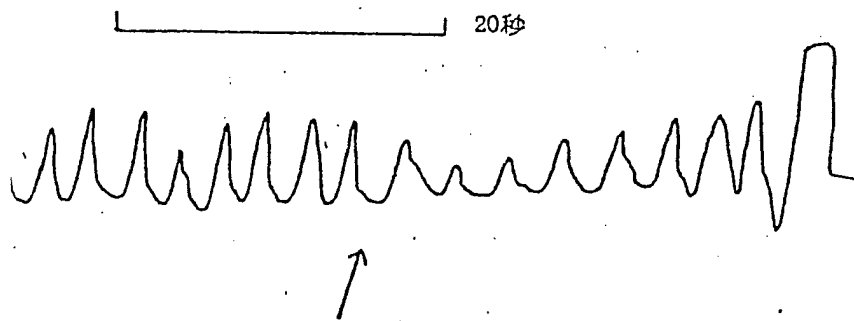
1. 20 seconds]

When air is inhaled, a rising curve is recorded; the curve falls when air is exhaled. When an examinee is calm, the respiratory rhythm is stable and relatively regular curves are recorded. When a change

occurs in the examinee's emotional state following presentation of a stimulus, the respiratory rhythm is altered. Therefore, an examinee's emotional changes can be detected by observation of changes in respiratory tracings.

2. Evaluation

Three types of respiratory wave responses corresponding to emotional changes are: 1) changing baseline, 2) suppression (including block suppression), and 3) confusion. The figure below shows the suppression response, which appears most often.



[Key to Fig. 4: Suppression

1. 20 seconds]

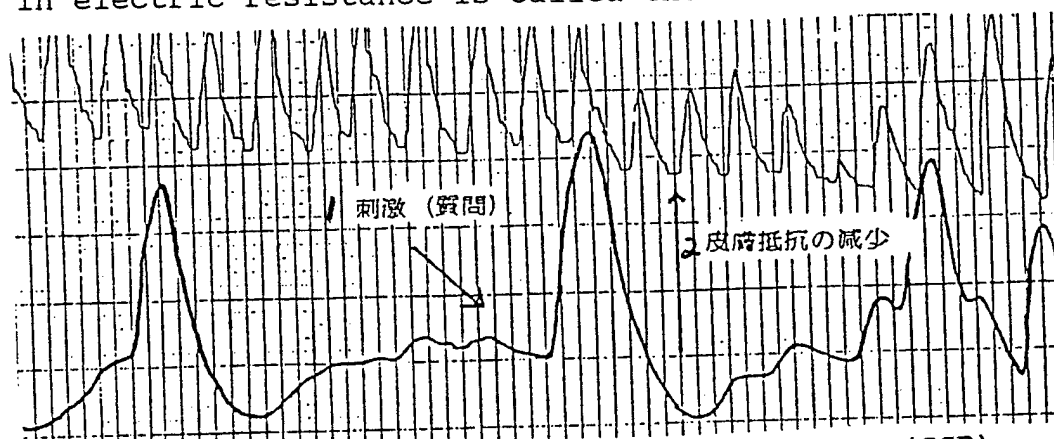
The record in Figure 4 gives a typical example of suppression, which manifests itself in various patterns with reduced amplitude of the respiratory wave after presentation of a question. The figure

indicates the process of graduated amplitude diminution and recovery. At the end of the suppression, the examinee has taken a deep breath.

1.4.2 Skin Resistance Response (or skin electric response, GSR)

1. Measurement

Silver electrodes are attached at two places on examinee's palm. A weak electric current at a level of several microamperes may readily be passed through the palm because the human body is a semiconductor. If, however, the electric current is increased above a certain level, an impeding force develops. This impedance is called the electric resistance. When an external stimulus is presented followed by an emotional change, this electric resistance decreases rapidly; after several seconds it recovers to the original level. A record of the change in electric resistance is shown in Figure 5. This transient change in electric resistance is called the skin resistance response.



[Key to Fig. 5: Skin Resistance Response (GSR)]

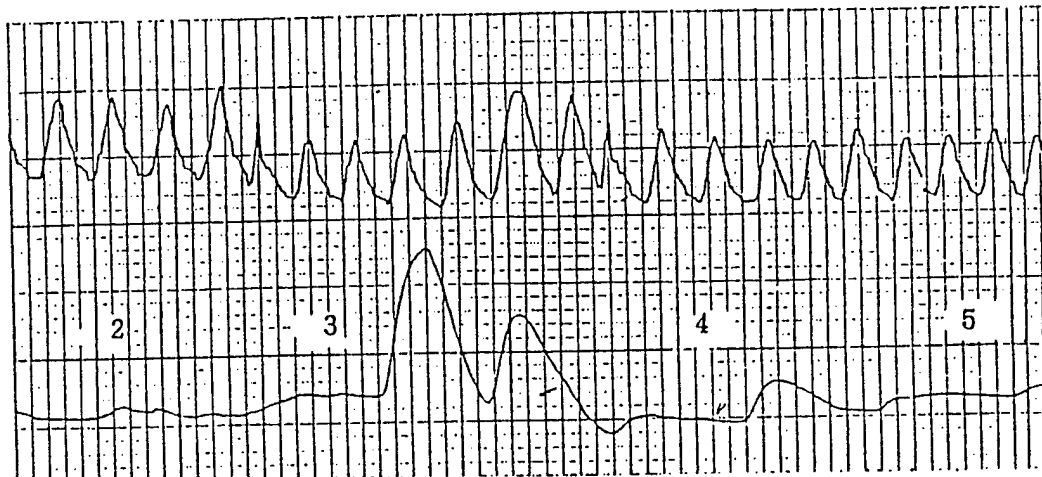
1. Stimulus (question)
2. Reduced skin resistance]

2. Evaluation

GSR based evaluation essentially relies on visual comparison of amplitudes of response evoked by individual questions. Figure 6 shows GSR records for several questions. This record indicates that the examinee's maximum change of emotion has occurred to the question in position Number 3.

GSRs are characterized by sensitivity to stimuli, giving quickly rising tracings with relatively short response times. Therefore, visual comparison of responses to individual questions is relatively easy.

However, being a sensitive index, GSRs appear in association with only slight emotional changes. In Figure 6, GSRs appear in response to questions indicated by numbers at all positions, even if they are small in amplitude. A relatively large response, called the orienting response, often appears, especially in response to the first question in the series.

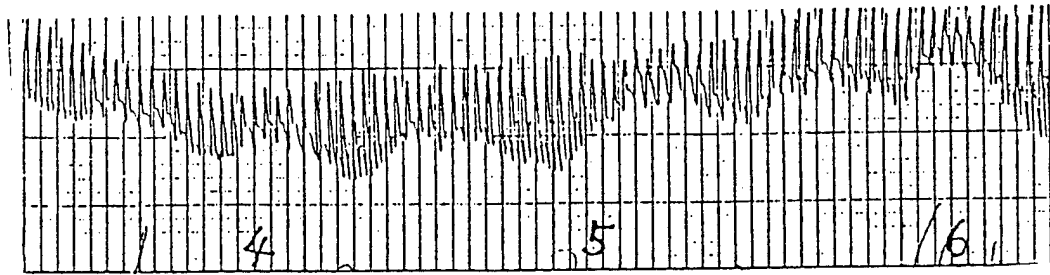


[Key to Figure 6: Skin resistance response record]

1.4.3 Cardio Waves

1. Measurement

Cardio tracings are simultaneous measurement of pulsebeat and blood pressure change. A cardio cuff is attached to the examinee's upper arm, air is injected into the rubber bag inside the cuff to pressurize this part. The expansion and contraction of the bellows caused by the shifting air pressure are recorded.



[Key to Fig. 7: Cardio tracing]

2. Evaluation

While not as sensitive as GSR, the cardio tracing is nevertheless an effective index, because it responds reliably to relatively intense types of emotional change. Figure 7 shows cardio tracings. The cardio amplitude becomes small in response to the question at position 5, ; at the same time, the whole tracing shifts upward. The record indicates that a relatively great emotional change occurred at the place where question Number 5 was presented.

1.5 Question Method

The question method refers collectively to such aspects as the form, purpose, and contents of questions. Two types of question methods are chiefly in use at present. They are the peak of tension test (POT) and the control question test (CQT).

1.5.1 POT

One list of questions consists of four to six questions, among which one refers to the case to be investigated. The following is one such example.

Example of POT

1. Do you know that the victim was strangled with a towel?
(noncritical question)
2. ". . . a necktie? (noncritical question)
3. ". . . a leather belt? (critical question)
4. ". . . a wrapping cloth? (noncritical question)
5. ". . . a muffler? (noncritical question)

The list above was actually presented to the suspect of a murder case in a polygraph test. The outline appears below.

The criminal registered at resort hotel P with the victim (a 34 year old bar hostess) at about 11 p.m. When leaving next morning at around 8, the criminal requested the desk to "Wake the woman up at 10 o'clock." Because there was no answer at all to knocks on the door around 10 o'clock a hotel employee entered the room to find the victim in bed with a woman's leather belt twisted around her neck. The victim was presumed to have been strangled early in the morning.

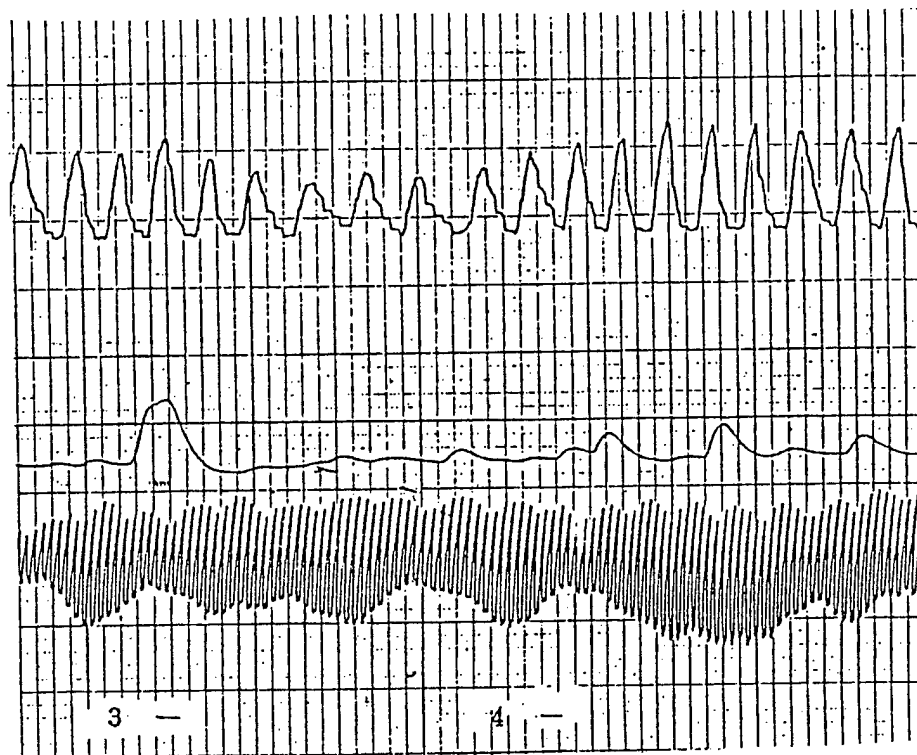
The examinee (suspect) had been denying any connection with this

murder case. He stated that because he had not read any newspaper other than a sports paper, he had not been aware of such a murder case at all. Naturally, he testified that he had not met the victim. Therefore, his contention was that he had no detailed knowledge of the crime.

The question, "Do you know that the victim was strangled with a leather belt?" is considered the critical question, because it contains one of the details concerning the case, "the object used for strangling." The other questions in the same list are non-critical questions. The items referred to in the non-critical questions do not have anything to do with the crime under investigation.

The examiner presented the question list to the examinee. The method of presentation was to read questions one by one at a certain interval (about 20 seconds).

If the examinee were totally unconnected to the crime, he would answer "I don't know" to the question on the item used to strangle the victim and he would not display any great emotional change to any specific question. If the examinee were hiding the fact that he was the real criminal, the test result would be different.



[Key to Fig. 8: Test record (partial) in Response to a POT Question List]

The test record in Figure 8 clearly reveals that this examinee responded with a prominent emotional change to the specific question shown. Numbers written at the bottom of the record represent question numbers. Places marked by the sign " - " denote negative answers by the examinee saying, e.g. "I don't know." The examinee denied knowledge of the answer to the critical question at number "3." The

most conspicuous physiological response that appeared to the critical question was the breathing wave. A clear "suppression" response appeared.

When administering a POT a few problems must be kept in mind. Even those who have nothing to do with the crime may have some knowledge of detailed facts relating to the place of the crime, which is known to the real criminal (e.g. "a leather belt" used for strangulation). Some may remember facts learned from newspapers or TV reports about the case. If the examinee is extremely tense, even facts not obtained at first hand may have the same effect as personal experiences and may thus affect the test record. Therefore, before presenting the question, the examiner must ascertain the extent of the examinee's knowledge of the case.

As to detailed facts to be used in a critical question, the item is so chosen that the criminal cannot escape noticing it. In the murder case outlined above, in addition to the item used to kill (the leather left), the position the victim was found in or the victim's clothing are appropriate. However, the position of furniture in the room is not so appropriate. For example, if the position of the TV in the room is used in a critical question, the probability is low for someone who killed in a fit of violent emotion to remember it precisely.

As described above, if the examinee is hiding the truth, at the presentation of a critical question that contains a detail that the

criminal must recognize, physiological responses appear that are prominent when compared to responses to noncritical questions. As a result, the examinee is judged to have detailed facts about the place of the crime despite his denial prior to the question presentation.

1.5.2 CQT

CQT lists consist of relevant questions, control questions (including hypothetical crime questions), and nonrelevant questions.

Using a direct mode of expression, a relevant question addresses the extent of the examinee's involvement with the crime being investigated. The relevant questions concerning the murder case at the resort hotel P described above are given below.

Examples of relevant questions

Do you know the criminal who strangled a woman last Saturday night at resort hotel P?

Was it you who strangled a woman the night of the 4th at resort hotel P?

Do you know the person who strangled a woman about 30 years old on Saturday a night at the beginning of this month at resort hotel P?

If questioned directly using expressions described above, examinees who have committed the crime but are hiding it respond with strong emotional changes. The psychological condition that evokes this strong emotional change is called guilt awareness or awareness of guilt.

A judgment of guilt awareness is not made solely on the basis of physiological changes that represent emotional changes in response to relevant questions that refer to the contents of the crime. Such judgments are reached only after comparative evaluation of physiological responses to control as well as to hypothetical crime questions.

The following examples of control questions can be offered.

Example of control question

Did you hit a woman who was trying to entice clientele into a bar on a street behind S station at the end of last month?

Conditions for setting up a control question are that it deals with a crime of approximately the same quality as the crime being tested and, further, that examinee's answer to the question is certain to be false.

And the following example of a hypothetical crime question can be

offered.

Example of a hypothetical crime question

Was it you who stabbed a young woman with a knife in front of bar
R the night of January 10th of this year?

As the content of a hypothetical crime question, choose a fictitious crime similar to the crime being investigated. However, the content needs to appear very realistic to the examinee.

Direct expressions used for relevant questions are liable to evoke emotional changes even in examinees who have nothing to do with the crime being tested. So, these control and hypothetical crime questions are presented to determine the presence or absence, or the degree of guilt awareness by evaluation that compares physiological responses that occurred in response to control questions with those to relevant questions. In addition, a control question list contains nonrelevant questions. Personal matters relating to individual examinees are used as content. For example, the examinee's name, age, or address. To function as a buffer, nonrelevant questions are placed at the beginning of the list, or between a relevant and control or hypothetical crime question.

A control question list combines different types of questions. As a result, physiological responses evoked by different types of questions

must be compared and evaluated.

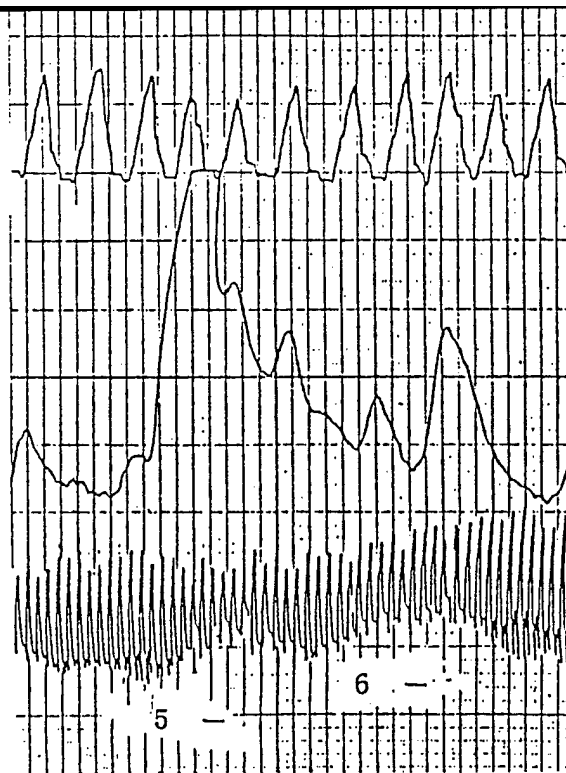
1.6 Evaluation

When giving a polygraph test, one CQT list is combined with 5-6 POT lists.

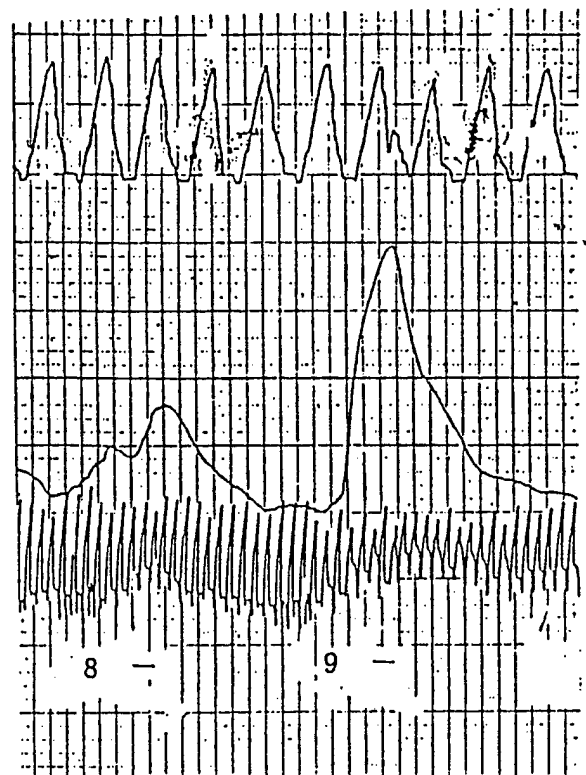
The CQT aims at determining examinee's guilt consciousness (or guilt consciousness) in regard to the crime. And the POT aims at evaluating whether the examinee recognizes detailed facts about the crime.

Evaluation based on test records is done through visual comparisons of three indexes of physiological responses.

With the CQT test records, physiological responses to relevant questions are visually compared to those that occurred to control questions as well as to hypothetical crime questions. If, as a result of the comparison, the physiological response to relevant questions are obviously more prominent these responses are called specific responses.



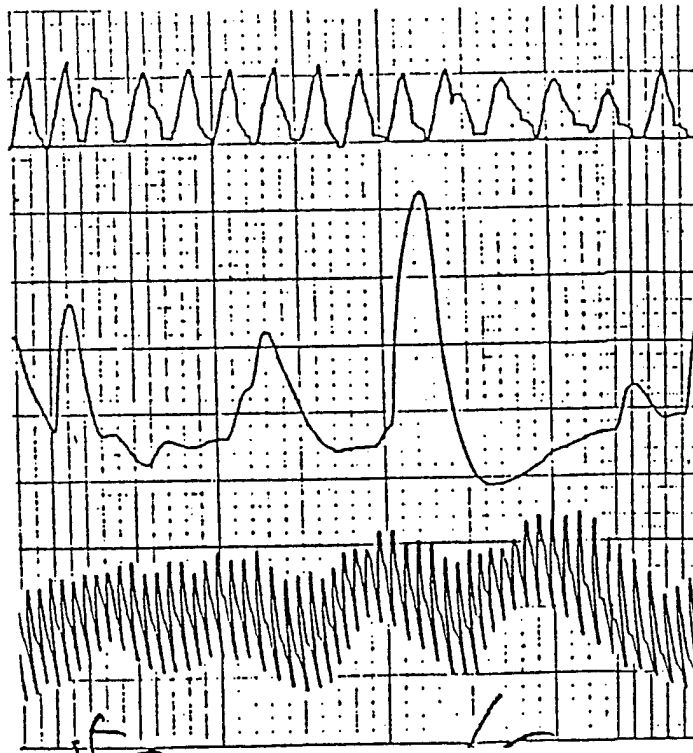
[Key to Fig. 10: Comparison Between a Relevant Question and a Control Question]



[Key to Fig. 11: Comparison Between a Relevant Question and a Hypothetical Crime Question]

Figure 10 is part of the test record corresponding to the presentation of a control question list. Physiological responses (especially GSR and respiratory waves) to the relevant question (question Number 5) clearly differ from those that occurred in response to the control question (Number 6). The evaluation in this case is that specific response has appeared in response to the relevant question. (Another way to express it is that the response is specific). Figure 11 compares a relevant question (question Number 9) to a hypothetical crime question (question Number 8). Physiological responses to the relevant question (especially GSR and cardio tracings) are clearly more prominent when compared to those that occurred in response to the hypothetical crime question. This responses is judged to be specific.

While all three indexes are positive in response to the relevant question (question Number 5) in Figure 12 of the test record, they are not particularly prominent if compared to those to the control question (question Number 6). Therefore, the response to this relative question cannot be called specific.

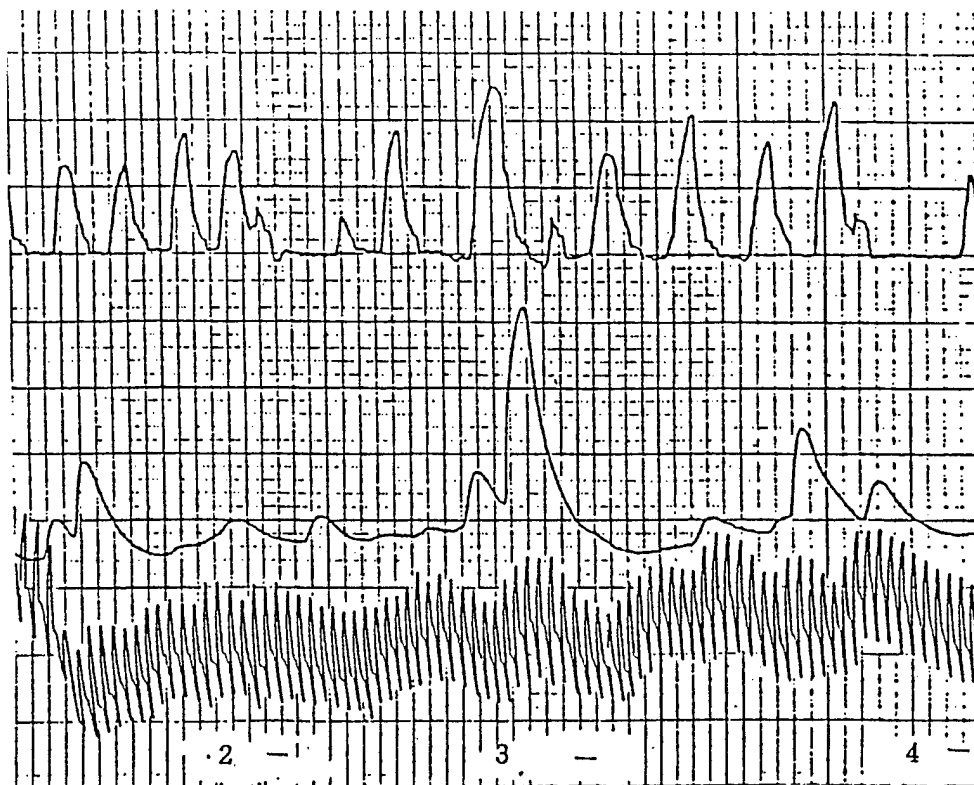


[Key to Fig. 12: Comparison Between Relevant and Control Questions]

In a CQT test the same question list is presented three times. As a result, if specific responses appear each time in response to a relevant question, the examinee is evaluated as having an awareness of guilt about the crime being investigated.

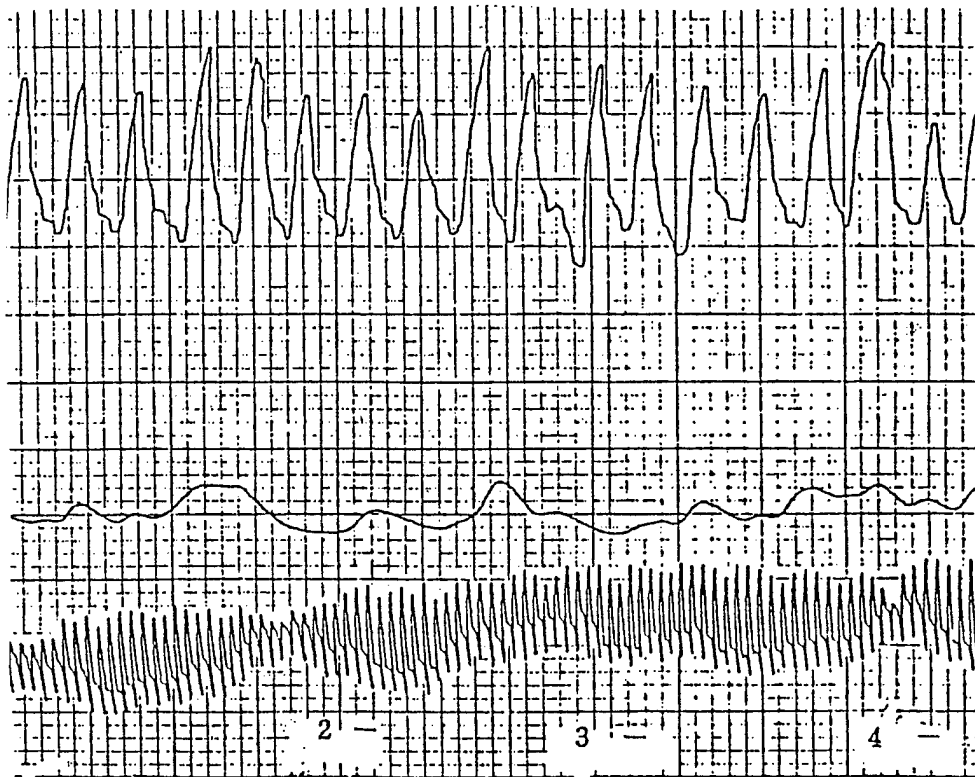
On the other hand, with POT one critical question (a question that contains a detailed fact relevant to the crime) as well as 3-5 noncritical questions (questions approximately equal in meaning or in value to a critical question in view of the third party) are prepared and combined to construct a list. After the presentation of the question list, records of physiological responses to critical and noncritical questions are visually compared. As a result of this comparison, if physiological responses to a critical question are clearly different from those to non-critical questions, a conclusion of the presence of a positive specific response to the critical question is arrived at.

In the (partial) record shown in Figure 13, the critical question was presented at the Number 3 position. Physiological responses (especially GSR and cardio tracing) to this question are specific, obviously differing from those to noncritical questions. And the critical question in the record shown in Figure 14 was asked at the number 3 position. Physiological responses to this question and those to noncritical question do not particularly differ. Therefore, this test record is evaluated as no specific response having appeared to the critical question.



[Key to Fig. 13: Comparison Between Critical and Noncritical Questions]

For the most part the same POT lists are repeated three times. When stable specific responses appear to critical questions, the examinee is judged as having recognized detailed facts about the crime used as contents of critical questions, despite their statements to the contrary before presentation of the questions.



[Key to Fig. 14: Comparison Between Critical and Noncritical Questions]

2. Overview of Polygraph Testing

2.1 Polygraph Test

The so-called polygraph test is defined as the use of polygraph equipment to measure physiological responses to determine whether or not a person is telling the truth. This technique utilizes the fact that the physiological changes that accompany emotional states manifest themselves relatively involuntarily.

At least three processes are involved in eliciting physiological responses in polygraph testing: 1) Examinees focus their attention on questions that are most significant to them; 2) examinees respond with anxiety or fear to certain specific questions; and 3) examinees' mental effort to deceive, or their motivation to defeat the test, acts as a factor that elicits specific physiological responses. These processes have a more rigorous influence on the guilty than on the innocent. In the actual test situation, the three processes act simultaneously to elicit physiological responses when the examinee is lying.

The following points will be outlined here: 1) Physiological changes that accompany emotion; 2) falsehoods and the polygraph test; and 3) historical background.

2.2 Polygraph Test Procedures and Techniques

Two test methods are in use in Japan. The first is the Control Question Test (CQT) and the second, the Peak of Tension Test (POT). CQT means measurement of physiological responses to determine whether examinees have a guilt consciousness or not regarding the crime targeted in testing. POT means measurement of physiological responses to determine whether or not examinees recognize detailed facts concerning the crime that only the perpetrator would know.

A CQT consists of a pretest interview and measurement of physiological responses that follows. After the pretest interview, questions are presented using lists, combinations of nonrelevant, relevant, and control questions in a certain order; examinees answer each question and physiological responses to each are measured. Nonrelevant questions are personal matters regarding examinees, e.g. name, age, or address. Non-relevant questions aim to 1) ascertain the general character of the examinee's physiological responses and 2) introduce relevant and control questions that follow. Relevant questions have content relevant to the crime being investigated; they are asked to elicit physiological responses that provide clues to evaluate whether the examinee has a guilt consciousness. Control questions do not directly deal with the crime being investigated, but are about crimes that are generally of the same nature as the crime under investigation. Control questions must have contents to which examinees will answer falsely with a very high probability. Control questions aim to 1) confirm physiological responses to false answers and 2) divert innocent examinees' "psychological guard" against relevant

questions.

Basic hypotheses underlying CQT are: 1) If the examinee is answering truthfully to relevant questions, his/her psychological guard will be directed to control questions and 2) if the examinee's answers to relevant questions are false, his/her psychological guard will be directed to questions, to which false answers are given making control questions only of secondary importance.

The POT aims at making the presence of knowledge about detailed facts concerning the crime clear. It differs from the CQT in the sense that it does not attempt to catch a guilt consciousness. Requirements for effective utilization of this technique are for the criminal to possess detailed knowledge of the case, while the innocent cannot possess such knowledge.

With the POT, only one item relevant to the crime is inserted among the usual number of questions, five to six, presented to the examinee. For example, under the assumption that a ring was stolen and that the criminal alone can identify this item, questions chosen will refer to 1) a brooch, 2) earrings, 3) a ring, 4) a necklace, and 5) a bracelet. If the examinee's physiological responses to the relevant item are consistently more prominent than to nonrelevant items, he/she is presumed to have recognized that item.

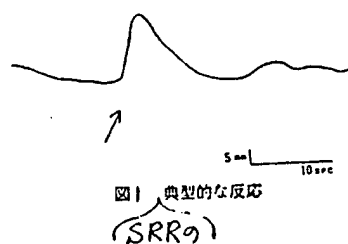
Basic hypotheses underlying the POT are: 1) The criminal who possesses

knowledge of the relevant item will respond to that item more prominently than to nonrelevant items and 2) the innocent who does not possess knowledge of the relevant item does not attach special meaning to the relevant item. Therefore, in a series of questions, responses toward the relevant item will not be markedly more prominent than responses to other items.

2.3 Physiological Indexes

Polygraph testing consists of simultaneous recording of 1) respiration, 2) skin resistance response (SRR), and 3) pulse wave.

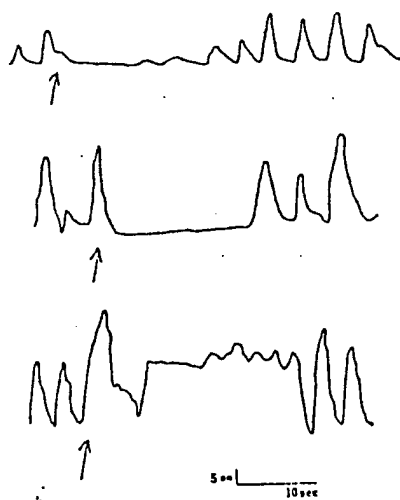
SSR is measured via electrodes attached at examinees' fingertips. Figure 1 shows a typical SRR response. The arrow indicates the place where the question was asked. The size of response reflects the magnitude of examinee's emotion regarding the question.



[Key to Fig. 1: Typical SRR response]

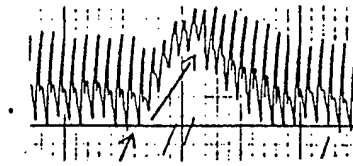
For the measurement of breathing a pneumatic tube is attached to

examinees' chest or belly. This index is considered the most reliable. Another advantage with this index is that it is possible to detect examinees' intentional attempts at distorting the test result. Breathing tracings take various patterns. Figure 2 shows one of such patterns called "block."



[Key to Fig. 2: Block]

The pulse wave is measured using the pressure cuff of the manometer attached to the upper arm. The cuff is connected via a tube to a pressure transducer that measures pressure changes. The cuff exerts pressure at a point between the systolic and diastolic phase. What is measured by this method is neither the blood pressure at the systolic phase nor at the diastolic phase, but the reflection of complicated combinations of the arm's blood volume and relative changes in blood pressure. Figure 3 indicates a typical pulse wave response, a rising baseline.



[Key to Fig. 3: Example of Rising Pulse Wave Baseline]

2.4 Test Validity

Actually to what degree does polygraph testing detect correctly what it intends to detect? Several studies on this problem are introduced below.

3. Respiratory Waves

3.1 Breathing Movements

Breathing tracing, one of the polygraph test indexes, is a record of examinees' breathing movements recorded by a pneumograph. Breathing, an indispensable physical function for the maintenance of our lives, has the function of taking in oxygen and expelling carbon dioxide from a living organism. The lungs, the breathing organs, are smaller than the chest cavity so that they are, more or less all the time, in a state of passive expansion from negative pressure. Human adults breathe on average 20 times per minute. The lungs do not expand or contract on their own. Movements of the diaphragm as well as of the ribs cause the expansion or contraction of the chest cavity, changing the inflation of air sacs, to let air come in or go out of the lungs. That is, with the expansion of the lung cavity, the lungs expand and air is inhaled through the air passage. This movement is called inhalation. In contrast, when the chest cavity narrows, the lungs contract to expel the air. This movement is called exhalation. Breathing consists of alternating inhalation and exhalation following a certain rhythm.

There are two major breathing patterns. As stated above, expansion and contraction of the chest cavity are caused by the movement of the ribs and the diaphragm that separates the abdominal cavity from the chest cavity. Normally one type of the movement is predominant. When

diaphragm movement is predominant, it is called abdominal breathing. When rib movement predominates, it is called thoracic breathing. When the predominant respiratory movement is not clear, it is called thoracic/abdominal breathing. In humans in a resting condition abdominal breathing dominates. When the person is weak or in a state of extreme fatigue, thoracic breathing predominates.

Respiratory rate usually is expressed in terms of the number of inhalation/exhalation cycles per minute. Respiratory rate is highest in infants, 40-60 cycles a minute. By the age of 8-9 the respiratory rate is within the range of 10-30; the average rate is 20 in the resting condition.

Posture also influences respiratory rate: approximately 16 when lying down and 20, when standing up. The rate naturally increases when walking or running. In the polygraph testing situation, respiratory rate ranges from 14.7 - 30.4 cycles per minute, while the mean is 19.1 (Inagaki, 1958 report, Psychology Department Meeting.)

3.2 Measurement of Respiratory Wave

The KT-1 model polygraph in use for polygraph testing directly records thoracic movement by attaching a pneumograph to examinees' chests. Movements that accompany examinees' breathing are transmitted to a bellows or tambour via the air sealed in a rubber tube. The tambour is mechanically connected to a kymograph and kymograph pens do the

recording. This method does not measure breathing quantitatively. However, despite its simplicity, this is an effective method for recording respiratory measurements. Especially used in actual polygraph test situations, the method has the advantage of not giving examinees an unpleasant feeling, making long and continuous measurement sessions feasible.

With the KT-2 model polygraph, the respiratory recording sensor contains saturated zinc sulfate liquid in a sealed container. The sensor records the breathing wave by converting it into electric signals.

3.3 Respiratory Records

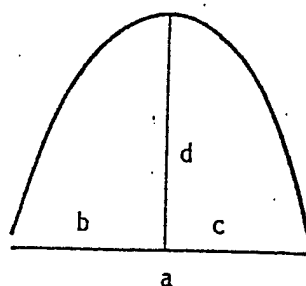


Figure 1 represents one respiratory cycle. The time required to complete one cycle is shown as "a", "b" is the time from the beginning to the end of inhalation, and "c" is the time from the beginning to the end of exhalation. "D" represents the depth of breathing.

Because the measurements recorded using a pneumograph tube represent only relative values of the depth of breathing, comparison is feasible within a continuous tracing of the same individual. However, data from different individuals cannot be compared. However, data on respiratory cycles are of relatively high accuracy.

3.4 Emotion and Respiration

The fact that changes in emotional state influence respiration has been known for a long time.

Already in the second decade of the twentieth century, Feleky pointed out that the ratio of measured time for inhalation and exhalation within one respiratory cycle changes under six different emotional states (pleasure, grief, anger, surprise, fear, and hate) compared to the normal state (Grossman, 1967). Skaggs (1949) investigated the relationship between specific emotional states and respiration in comparison to the respiration in a relaxed state. For example, compared to breathing in the relaxed state, (1) breathing becomes shallower and increases in frequency while silently doing multiplication, (2) respiration rate increases while feeling anxiety, although there is no change in respiratory depth, and (3) similarly, the respiration rate increases and respiration becomes irregular with no change in respiration depth when in a state of psychological shock or strong surprise.

These phenomena can be explained as follows: In the case (1) of mental work where no muscular activities are required, this type of respiratory pattern appears because of the effort to obtain the maximum effect from breathing as quietly as possible, while maintaining the standard oxygen level. In cases (2) and (3) where emotion is involved, the respiratory rate increases because of muscular activity or, at least, physiological preparation for muscular activity that takes place.

Stevenson and Ripley (1952) obtained detailed observations of respiratory tracings recorded using pneumographs of people who had bronchial asthma and were afraid of developing an asthmatic attack. Respiration under emotional stress was compared to the standard recorded when each individual was in a relaxed mood or was remembering pleasant things. A summary of the results of the study follows.

- (1) Increases in the respiratory rate and respiratory depth were observed: a) when anxious, and b) when angry.
- (2) Decreases in respiratory rate and respiratory depth were observed: a) when anxious, b) when angry, especially when indignant without feeling any anxiety, and c) when disappointed or sad.
- (3) Irregular respiratory tracings were a) almost absent when anxious, but b) observed when feeling guilty.

These observations clearly indicate the close relation between respiration and emotion. That is, respiratory changes reflect the body's physiological responses to situations in which individuals have felt various psychological pressures. However, even in situations where no physical activities occur, the presentation of symbolic stimuli elicit the same responses. For example, even when preparing for a sport match, increases in respiratory rate and depth can be observed. On the other hand, the feeling of setback or despair bring about decreased respiratory rate and depth. If we place fear between these two, the breathing will reflect an irregular wave pattern. At any rate, a specific emotion and a specific respiratory pattern obviously do not necessarily correspond one-to-one.

3.5 The Effect of Respiratory Waves in Experimental Situations

The inhalation and exhalation time intervals in a resting state are not equal. The inhalation/exhalation [I/E] ratio is approximately $3/5$ ($= 0.6$). Respiratory cycle changes correspond to changes in the emotional state: The inhalation interval becomes longer, resulting in a larger I/E rate. When applied to lie detection, I/E in response to noncritical question ranges $0.45 - 0.65$, while the range of I/E in response to critical questions is $0.65 - 1.00$. Another method of calculation is called the inhalatory fraction. The time used for inhalation becomes the numerator and the time for the entire respiratory cycle, the denominator. For example, given the inhalation time of one second and the cycle of 3 seconds, $1/3 = 0.33$. The value

increases when a person is in an emotional state.

Benussi, an Italian who studied psychology in Germany, first applied this index to lie detection in 1914 (Woodworth & Schlosberg, 1964). Benussi set up an experimental situation simulating a court. Examinees were handed cards on which letters or numerals were written. Examinees were to answer a series of questions, in which these letters or numerals were used as critical questions. Examinees were instructed to give false answers to critical questions. The observer, who played the role of a "judge," sat facing the examinee and evaluated whether his statements were true or false based on his behavior. Benussi recorded examinees' respiration simultaneously using a pneumograph. While evaluations based on examinees' behavior failed almost totally, evaluations based on Benussi's I/E were successful almost 100 % in more than 100 trials. Benussi calculated the inhalation fraction on the average of 3-5 cycles before and after the examinees' answers.

Following the experimental method of Benussi, Burt (1921) studied respiratory tracings using elaborate procedures. Burt prepared four types of experimental situations. Examinees were instructed to give false answers. In order to prevent causing disturbances in tracings, examinees answered questions after receiving a signal from the experimenter. Burt used I/E as the index and calculated average I/E from 3-5 cycles before and after an answer. If the value of the pre-answer I/E minus post-answer I/E was plus, the examinee's answer was judged to be true, if minus, false. Burt's experimental results were

reported to be rather good, with a maximum rate of success of 73 percent.

Thackray and Orne (1968) used respiratory tracing along with skin resistance response and volumetric cardio tracing in their experimental study of polygraph tests. For an objective evaluation of the respiratory waves, they gave a certain score to respiratory and depth respiratory cycles. The value of rank order was used as index. Amplitude of two respiratory cycles occurring two seconds after question presentation was measured and the smaller was chosen to represent the question. Among the responses to individual questions, the smallest amplitude was ranked 1. In the same manner, the length between peaks of two respiratory cycles occurring two seconds after the questions were presented were measured. The response that showed the longest cycle among all the responses received the rank order value of 1. According to the results of this experiment, respiratory tracing clearly proved to be the worst index.

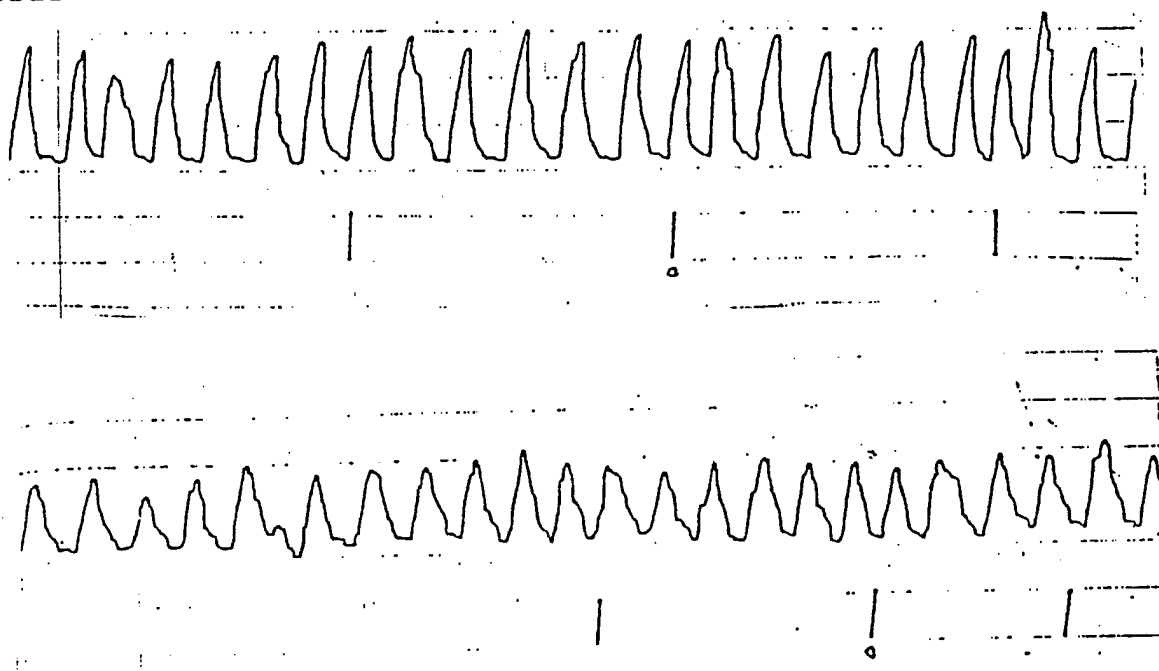
Experiments by Cutrow and others (1972) used respiratory amplitude and respiratory cycle time as indexes in their studies. Others evaluated included such measures as blinking response, volumetric cardio tracing, heart rate, skin resistance response, and the vocal latency. The average of two breaths was used as respiratory amplitude index; the minimum amplitude was regarded as indicating falsehood. The average of three cycles was used as the cycle time index; the maximum time was regarded as indicating falsehood. The response that showed

the most prominent falsehood received the rank order of 1. The mean rank order values of respective measures were calculated and compared to determine accuracy of lie detecting power. The result of the experiment was that the skin resistance responses measured in the palm with the mean rank order of 1.98 was the highest in accuracy. In comparison, the respiratory amplitude and cycle time, 2.46 and 2.60 respectively, were inferior to the skin resistance response, while better than heartbeat or blinking index.

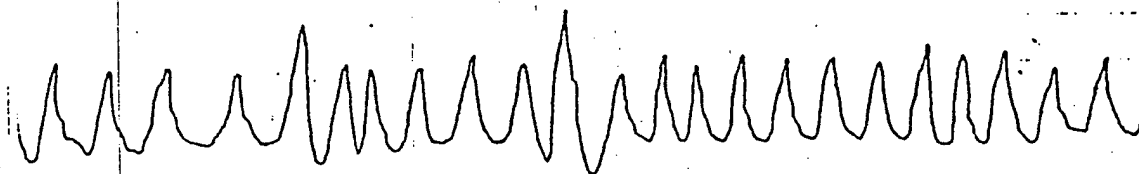
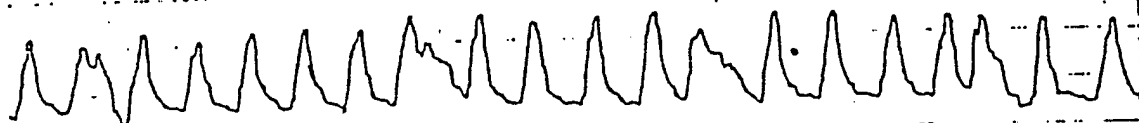
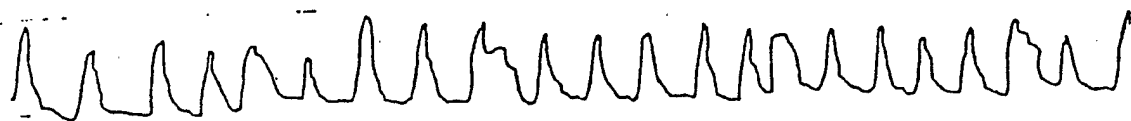
3.6 Evaluation of Response Pattern

3.6.1 Standard Respiratory Pattern

Normal breathing wave patterns have almost the same amplitude, horizontal baseline and stable cycle time (Figure 2).

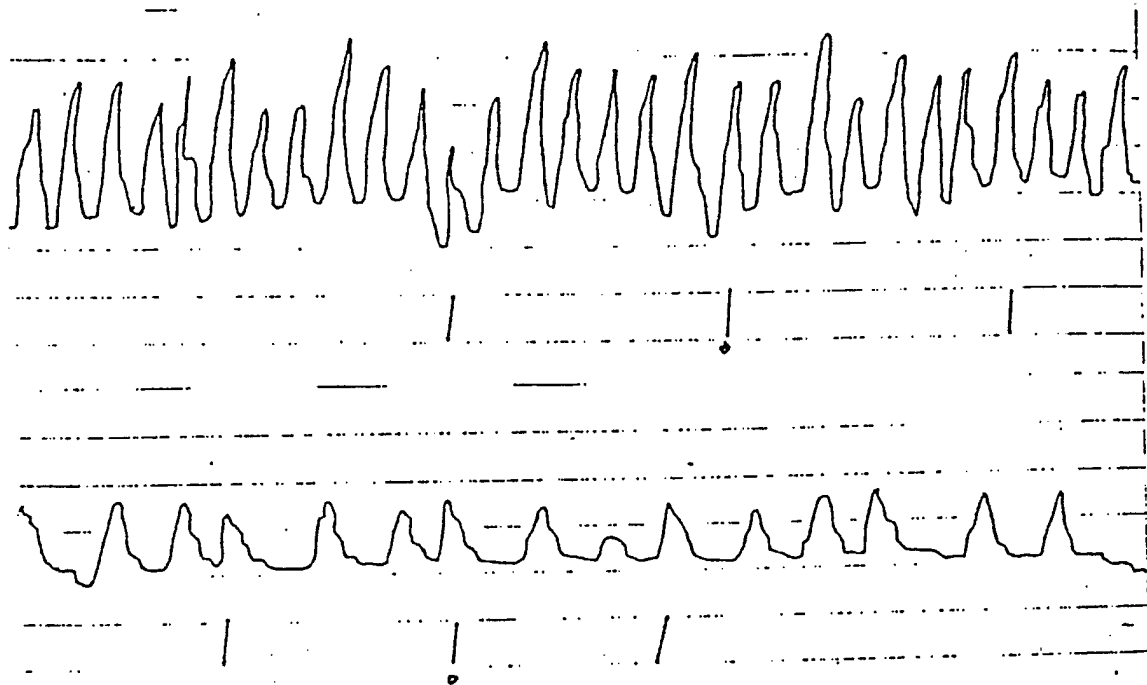


However, respiratory waves that we observe are records of those examinees who are answering questions. Therefore, it is rare for us to see tidy, well-ordered respiratory waves. At least the place where the examinee has answered would show irregularities (Figure 3).



The test situation itself sometimes makes examinees feel psychological pressure. The fact of being questioned itself, rather than question

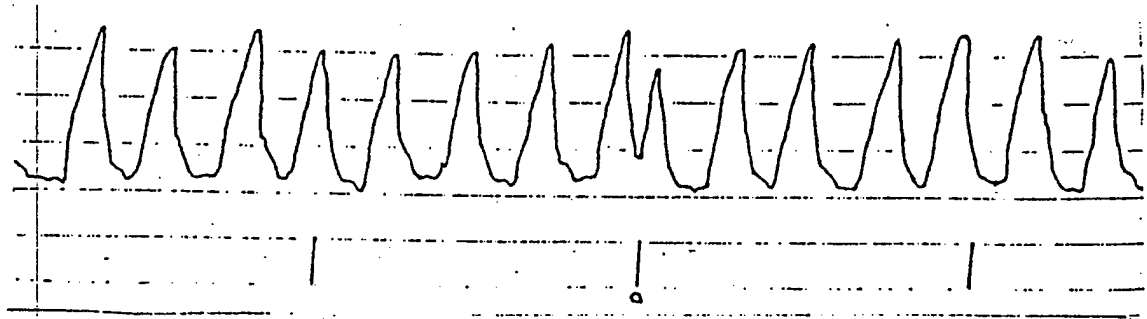
content, may act as stimulus even on examinees who have nothing to do with the case, with the result that all the respiratory waves may become irregular (Figure 4).



3.6.2 Respiratory Rate and Amplitude

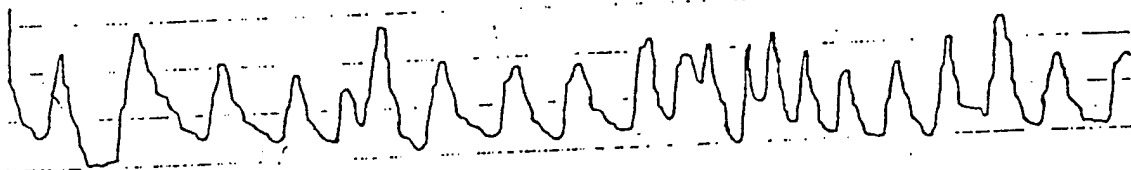
Normal respiratory rate for adults is approximately 20 per minute. There are, of course, individual differences. In Figure 5a, the rate is 12 times a minute, while in Figure 5b [not in text], it is 24 times a minute. The interval between questions should be determined after the visual confirmation of the respiratory rate. For the evaluation of

respiratory waves, at least 5-6 cycles are necessary. Evaluation becomes difficult when an examinee with a low respiratory rate is asked questions after relatively short time intervals, because changes in his respiratory waves cannot be observed sufficiently.

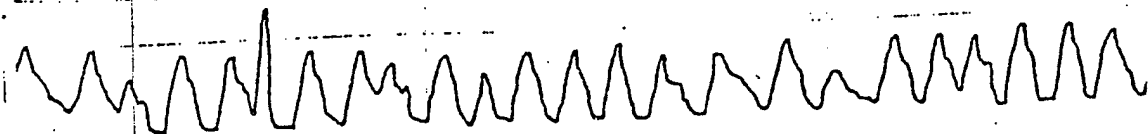
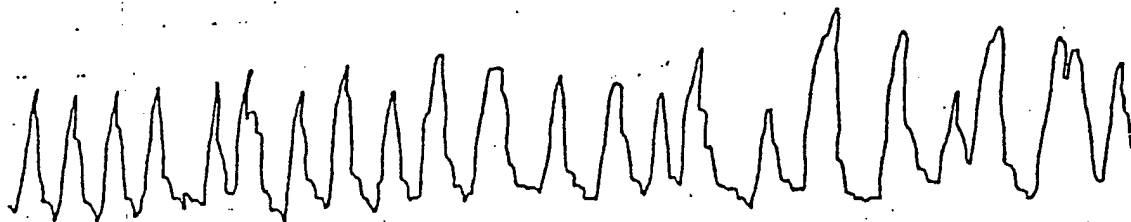


3.6.3 [sic] Changes in Respiratory Rate

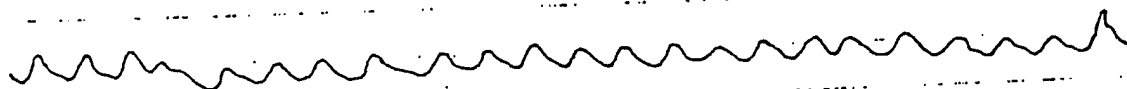
Respiratory rate begins to change immediately after the presentation of the question and the answer to it. When it is a critical question, such a response can be called specific. Increase (Fig 7a) or decrease (Figure 7b) in the respiratory rate occurs, while the baseline stays stable and the amplitude changes little.

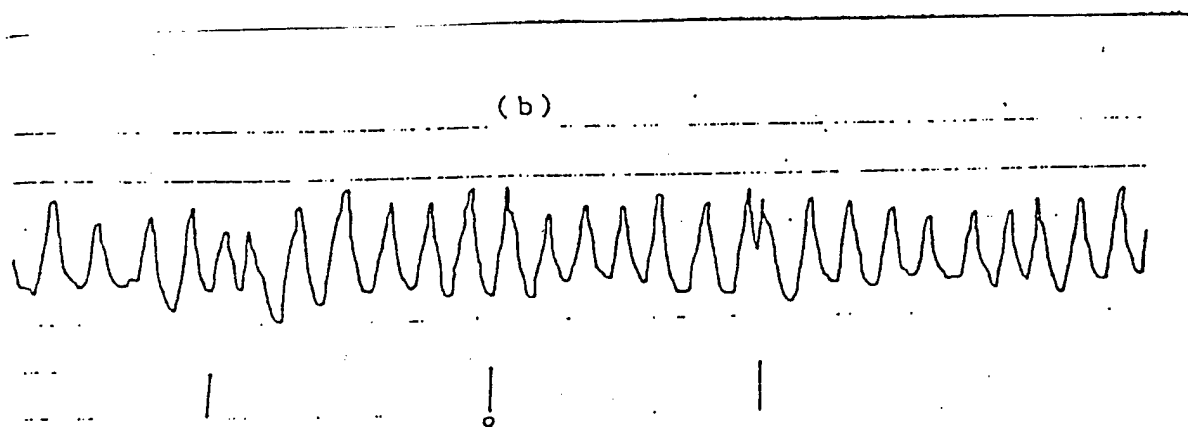
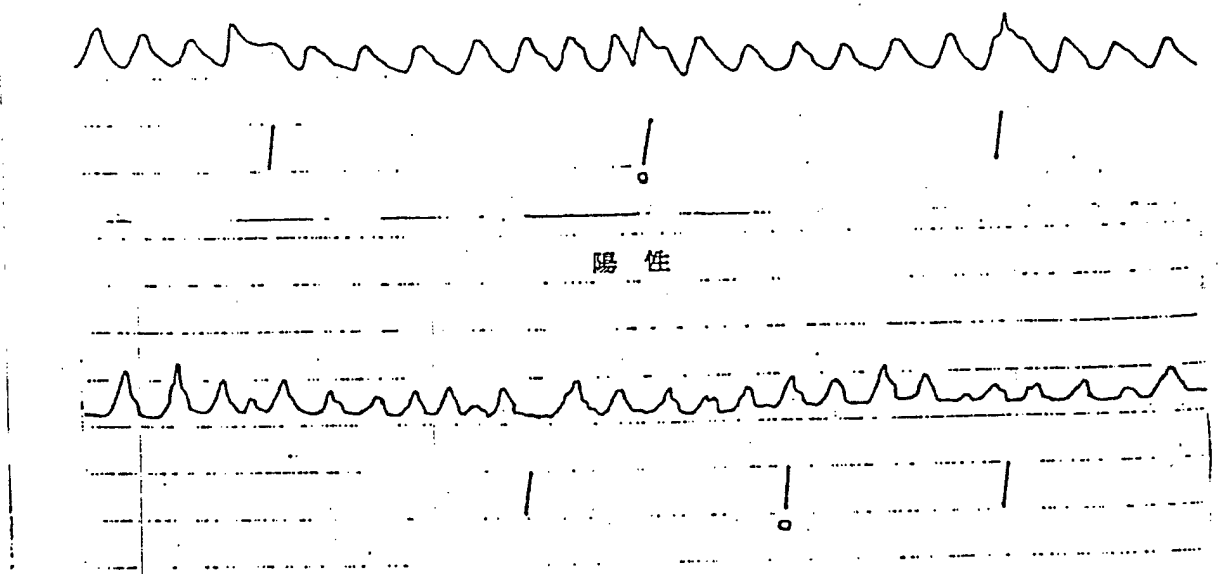


(b)



(b)





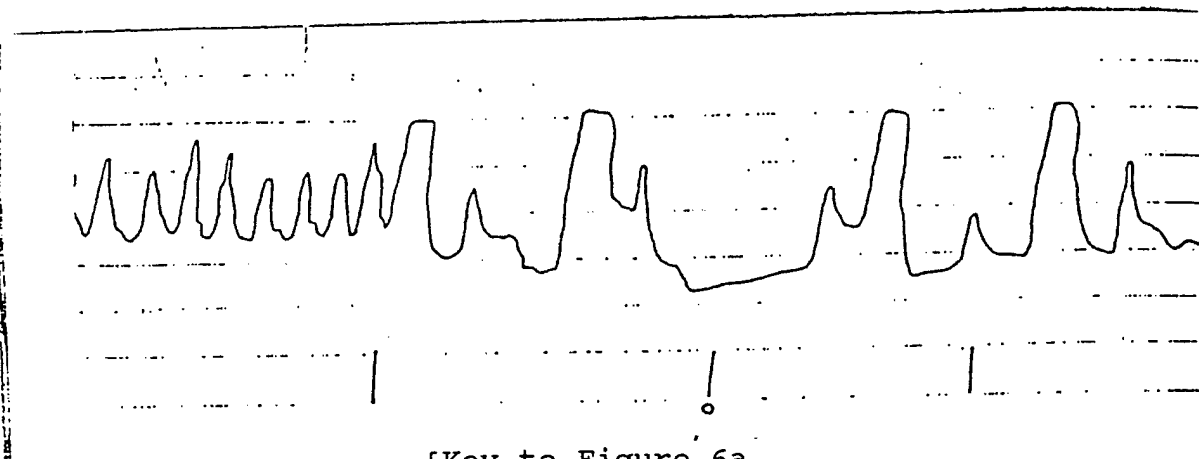
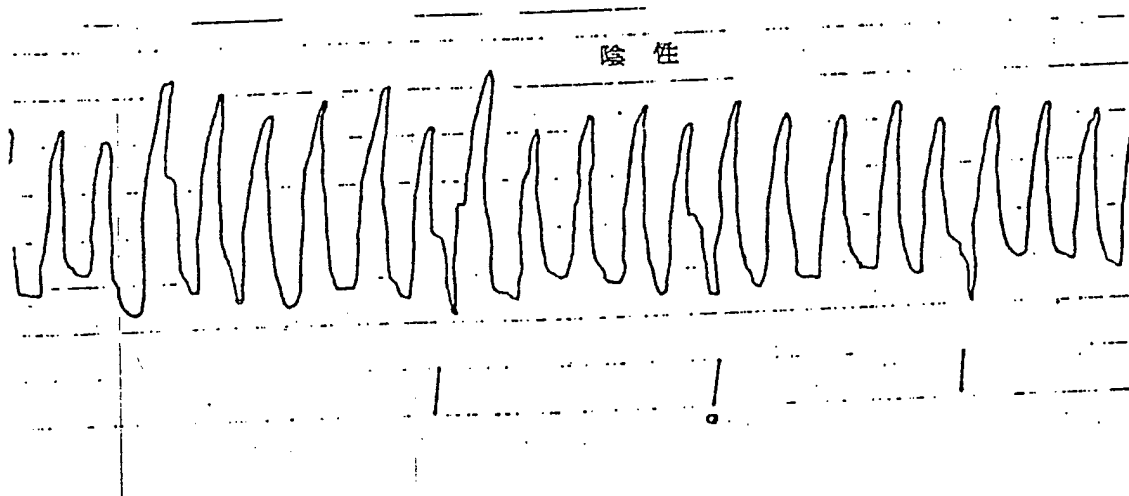
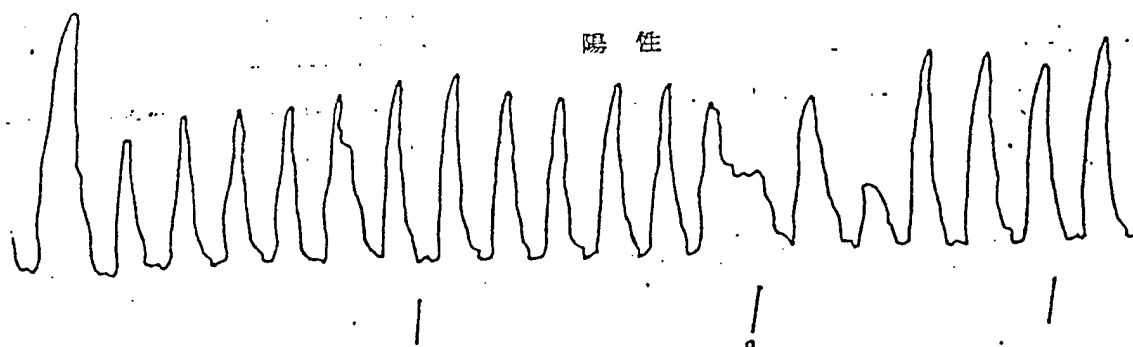
[Key to Figure 7b

1. Negative

2. Positive]

When an examinee exhibits quite high or low respiratory rates, the response tendency in itself cannot necessarily be considered meaningful. However, if the phenomenon deviates widely from the examinee's normal respiratory rate, an intentional interference on the part of the examinee should be suspected; especially when simultaneous disturbances in the baseline or amplitude are observed. Figure 8 shows a part of a confirmed positive record.

When recording respiratory waves using the KT-1 model polygraph, the amplitude adjustment is done mostly by adjusting the degree of contact between the pneumograph tube and the body part where it is attached. The amplitude for easy evaluation is said to be 2 - 3 centimeters. In actual testing, respiratory rates range from large (Figure 6a) to small (Figure 6b). Obese people or women clad in kimonos tend to record the type of respiratory tracing indicated in Figure 6b.

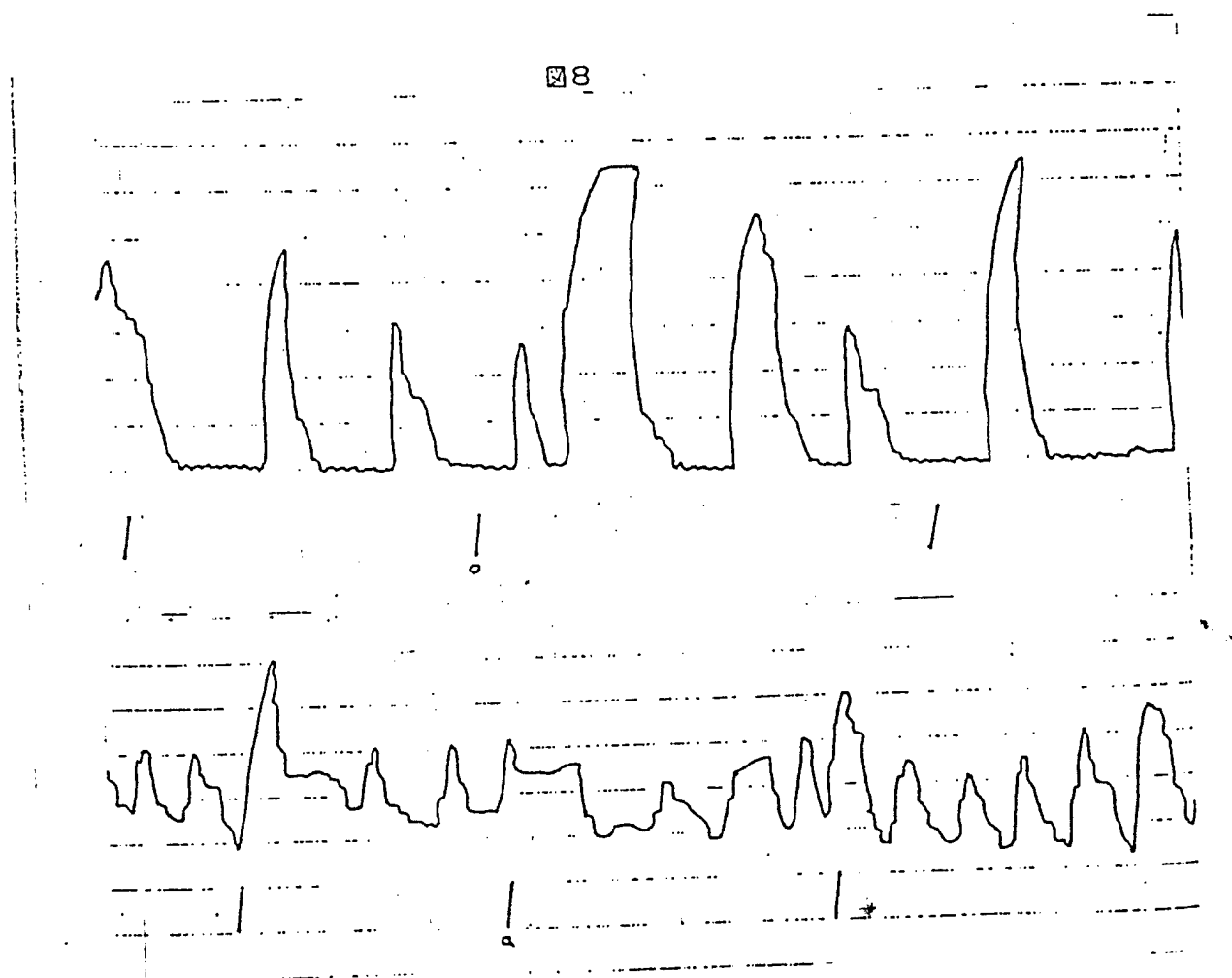


[Key to Figure 6a

1. Positive]

[Key to Figure 6b

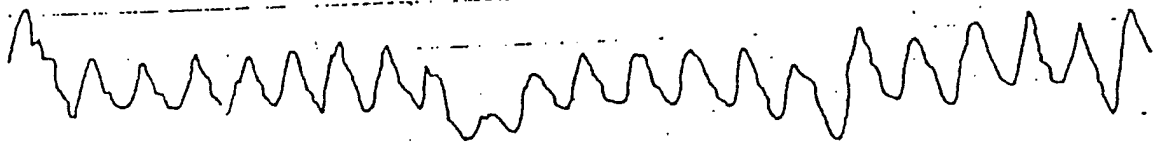
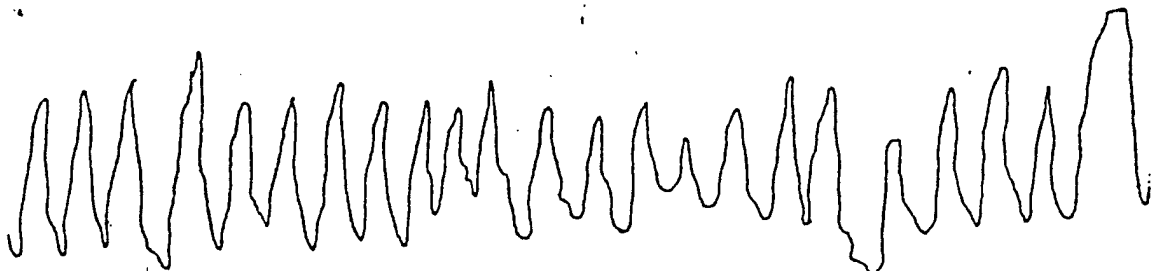
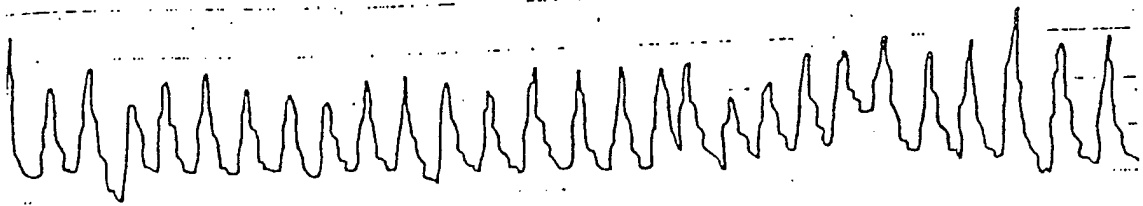
1. Negative]



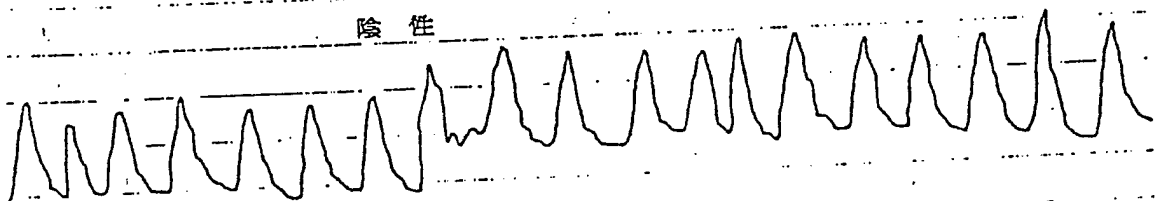
3.6.3 Shifts in the Baseline

The baseline climbs gradually directly following the question presentation and answer. In most cases, the baseline returns to the original level 10 - 20 seconds after the answer. When the question is a critical one, such a response is called specific (Figure 9).

9



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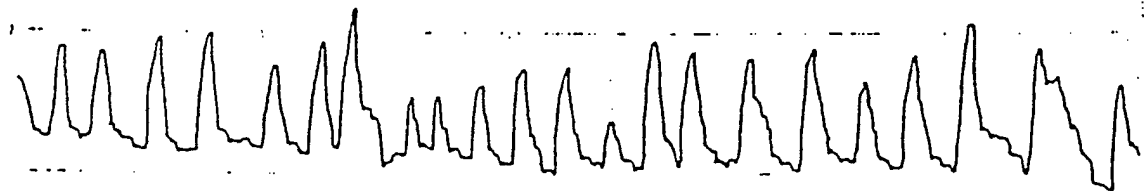
[Key to Figure 9

1. Negative]

3.6.4 Step Suppression

Diminished amplitude in response to a critical question is a typical example of a specific response. Such responses appear often in records later confirmed to be positive. The response pattern in which amplitude diminishes abruptly immediately following the answer and recovers in steps, is called step suppression (Figure 10).

10

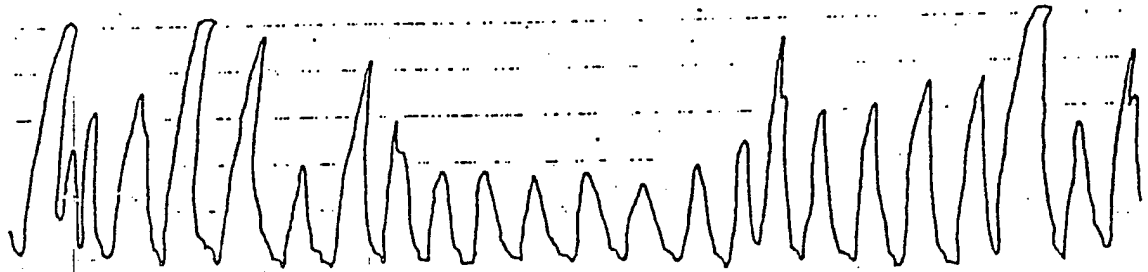
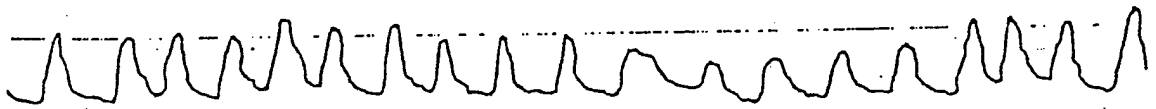
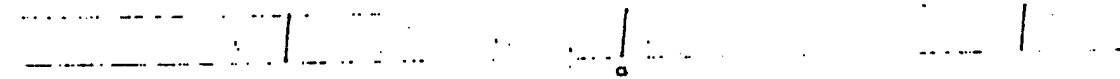
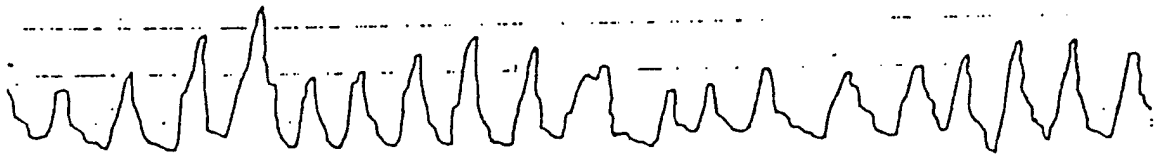


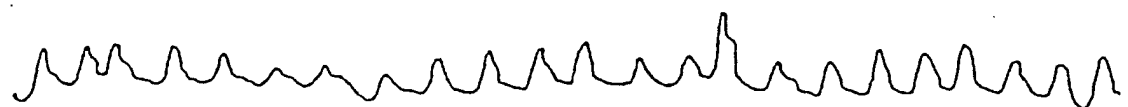
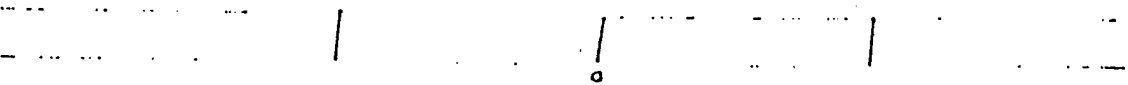
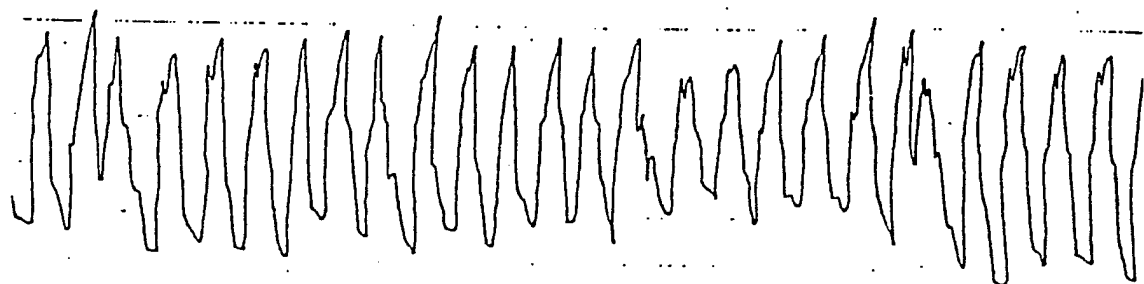
3.6.5 Suppression

Suppression is defined as diminished amplitude that appears abruptly after answering a question and stays at approximately the same level for several cycles. Figure 11a shows a variety of suppression, ranging from slight to prominent.

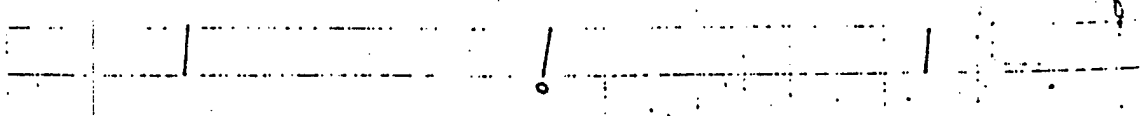
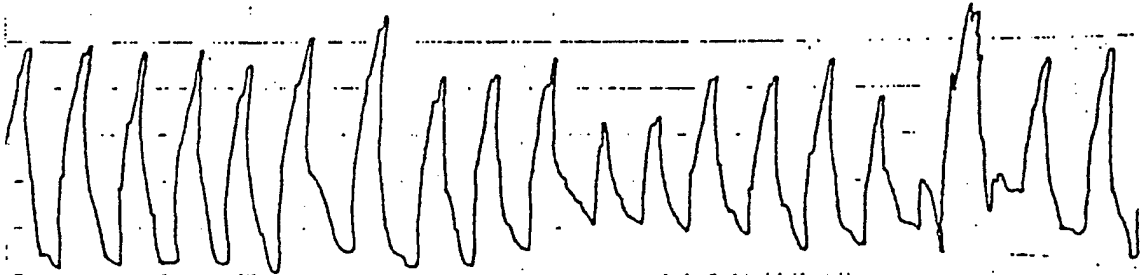
The phenomenon of suddenly enlarged respiratory amplitude that lasts for only one cycle following a suppressed response is due to the requirement to compensate for insufficient air supply: this is called relief response (Figure 11b).

11(a)





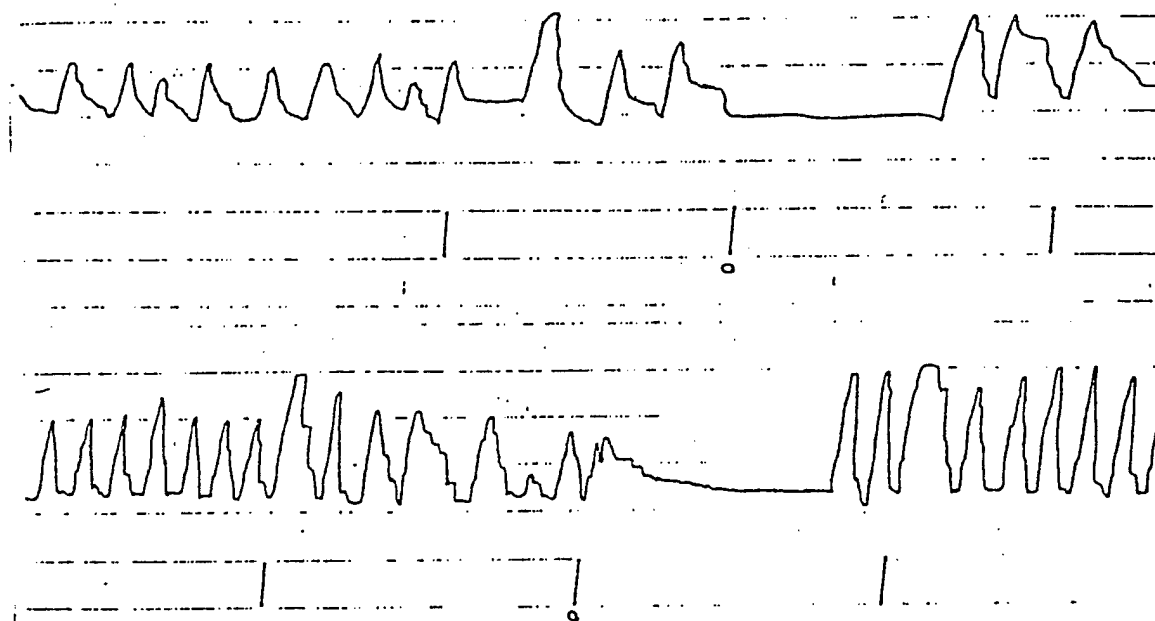
(b)



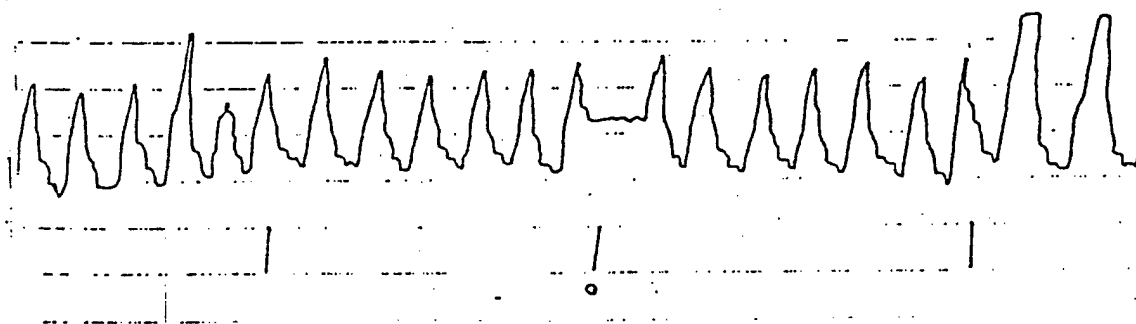
3.6.6 Block

The phenomenon of examinees stopping respiration for a certain duration immediately after answering a question, is called the block response. Occasionally a block response may last for 10 seconds or more as shown in Figure 12a. When a block response starts at the end point of inhalation, a raised baseline pattern appears (Figure 12b).

图 12(a)

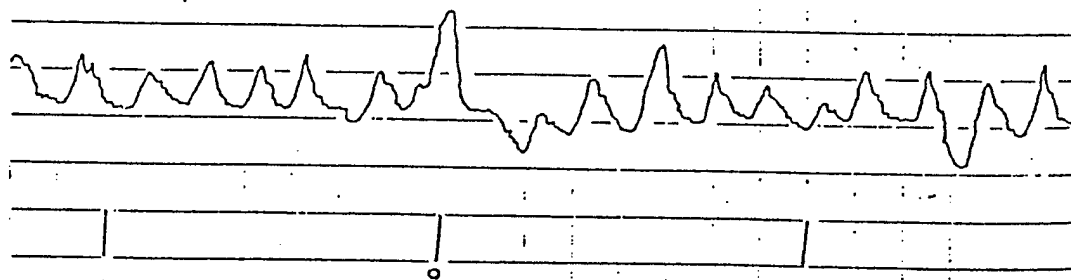
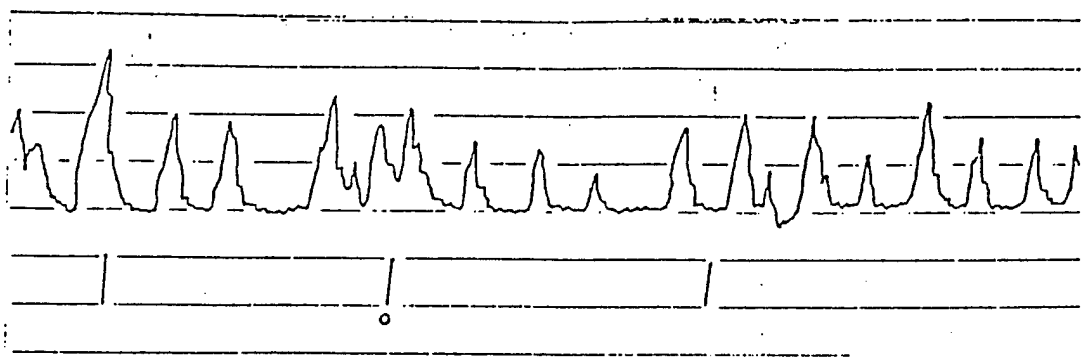


(b)



3.6.7 Sawtooth Response

The sawtooth response is the type of respiratory wave that shows small notches superimposed on a large wave that corresponds to a strong heartbeat picked up by the pneumograph tube. Notches appear clearer over an inhalatory curve than over an exhalatory curve (Figure 13). Sawtooth responses are not necessarily considered to be specific.



4. Electrodermal Responses

4.1 What is electrodermal activity?

Two methods of measurement of electrodermal activity (EDA) are the electric potential method and the electric charge method. The electric charge method measures skin resistance by applying a weak electric current. The electric potential method measures the difference in electric potential between two points on the skin. A transient change is called a response, while a lasting change is called change of level. The table below lists the main EDAs.

Figure 1

Measurement method	Electric potential method	Electric charge method	
EDA measured by the method above	SPA Skin potential activity	SRC Skin resistance change	SCC Skin conductance change
EDR electro-dermal	SPR Skin potential response	SRR Skin resistance response	SCR Skin conductance response
Level	SPL Skin potential level	SRL Skin resistance level	SCL Skin conductance level

Other EDR terms, e.g, GSR (Galvanic Skin Response), are to be found, but their use has gradually been falling out of fashion. The following is an explanation of the skin resistance response, most used in

polygraph tests.

4.2 Electrodes

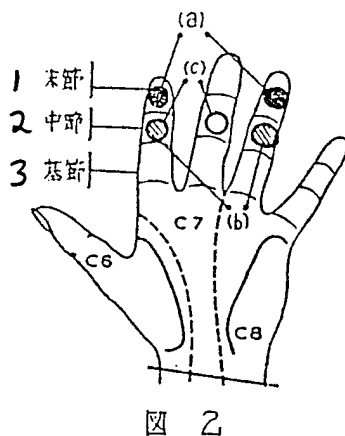
4.2.1 Types of Electrodes

The KT-1 model comes with silver as well as silver/silver chloride electrodes. The Lafayette polygraph uses stainless steel electrodes. Polarization occurs easily at the boundary between the skin and an electrode. Since silver/silver chloride electrodes exhibit little polarization, their use makes more accurate measurement possible.

4.2.2 Placement of Electrodes

Figure 2 indicates possible positions for electrode placement. Position (a) is generally preferred in polygraph testing. Use of the second and fourth fingers reduces the danger of the two electrodes coming into contact and causing a short-circuit. The advantages of (b) are: In comparison to the peripheral segment, the middle segment of a finger has smaller chance of being marked by scars and is less likely to be affected by finger movement. Fingers tend to bear many scars. Electrodes must be placed where there is no scar because even invisible scars have an adverse effect. The electrodes should not be placed on the hand that wears the cuff for cardiovascular measurement.

[Key to Fig. 2:



- [1. Peripheral segment of a finger
- 2. Middle segment of a finger
- 3. Base segment of a finger]

Before attaching electrodes to an examinee, wipe them clean with alcohol to remove dirt (especially greasy spots) that interferes with the flow of electric current.

4.2.3 Electrode glue

Electrode resistance is particularly great at the surface where the electrode comes into contact with the skin. In order to eliminate the space between an electrode and the skin from uneven skin surface, electrode glue (an electrolyte) is applied uniformly around the electrode. Either sodium chloride or potassium chloride are used as electrolyte.

4.3 Measuring Equipment

4.3.1 Bridge circuit

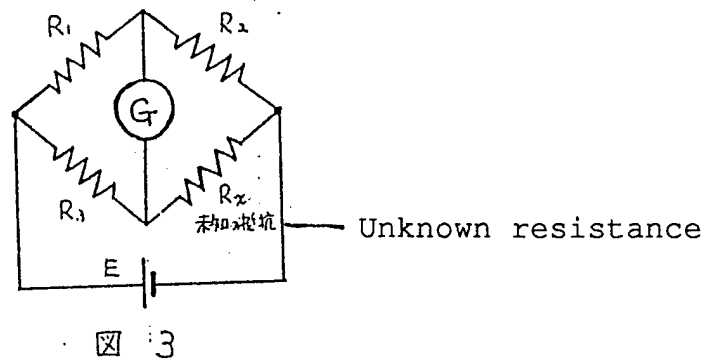


Figure 3 shows the basic circuit of a (Wheatstone) bridge. When no electric current goes through G , the equal strength current (I_1) flows through R_1 and R_2 ; likewise, the equal strength current (I_2) flows through R_3 and R_x . As in Ohm's Law (voltage (V) = Electric current (A) \times resistance (Ω), $E = I_1 \times R_1 = I_2 \times R_2$, $E = I_2 \times R_3 = I_2 \times R_x$. Therefore, $R_1 \times R_x = R_2 \times R_3$. If values for R_1 , R_2 , and R_3 are known, R_x can be calculated. In other words, if $R_1 \times R_x = R_2 \times R_3$, no electric current flows through G and the needle will not move. However, as R_x changes, the bridge becomes unbalanced and the current that goes through G will move the needle. Measurement of changes in SRL is made possible by using a bridge circuit. Skin resistance is determined by calibration.

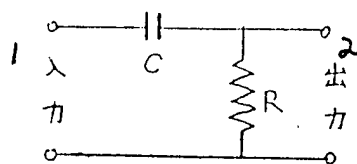


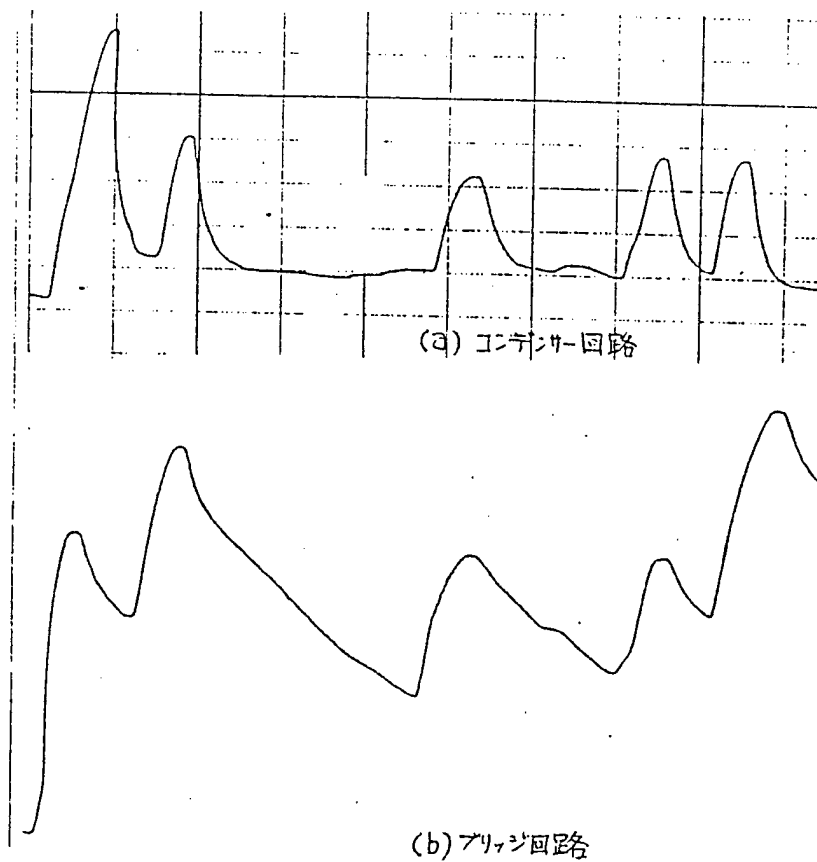
图 4

[Key to Fig. 4:

1. Input
2. Output]

4.3.2 Capacitor Circuit

A capacitor characteristically conducts only a suddenly changing electric current. As is seen in Figure 4, a high pass filter is incorporated into a capacitor circuit which acts to pass only high frequency components, while blocking low frequency component such as biological signals. Capacitor circuits record only SRR (the high frequency component) (cf. Figure 5), while bridge circuits record SRL as well as SRR.



[Key to Fig. 5:

(a) Capacitor circuit

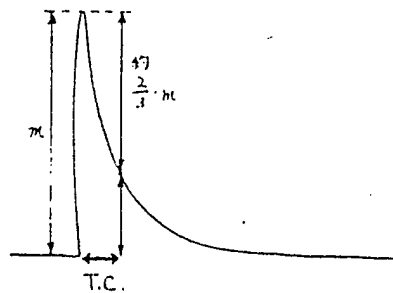
(b) Bridge circuit

(a) indicates SRC measured using a capacitor circuit; (b) indicates SRC measured using a bridge circuit]

In polygraph testing, capacitor circuits are used mainly in polygraph testing for reasons listed below. Procedures for measurement/recording using bridge circuits are complicated: No great SRL changes occur within one question series in polygraph testing: Records are evaluated on the basis of SRR sizes within one series, so that there is no need to know the values of the skin resistance.

4.3.3 Time Constants

The time constant is defined as the product of capacitance and resistance of the high pass filter ($C \times R = T.C.$ (seconds)). The larger the time constant, the lower the frequency component that filters through. The time constant can be determined from the calibrated wave form as follows: By pressing the calibration button continuously, a wave form as seen in Figure 6 is obtained. The time constant in this case is the time from the start of the wave until its amplitude has diminished by $2/3$.



⊠ 6

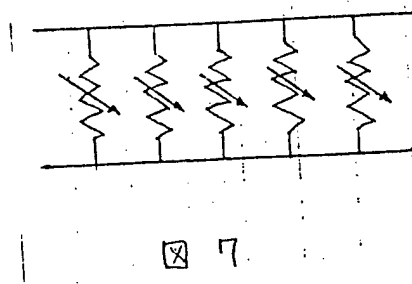
[Key to Figure 6

1. Approximately $2/3m$]

4.3.4 Electric Current Density of Electrode

The difference in electric potential generated at both ends of a resistor as electric current passes through is proportional to the magnitude of the filtered current ($V = I \times R$). However, this relationship does not hold if the filtering electric current alters

the value of the resistance (e.g., rising resistor temperature). When measuring SRC, the skin can be regarded as a type of resistor. The skin is affected by the passage of the electric current when the current exceeds a certain level. Therefore, the current intensity that flows into the skin must be within the range that allows maintenance of the proportional relationship between voltage and current. Skin resistance can be considered as consisting of many resistors connected in parallel (Figure 7). The number of resistors is determined by the skin area under the electrode. If a standard current flows into the skin, the intensity of the current is inversely proportional to the number of resistors (i.e., the area under the electrode). Therefore, for the skin to maintain a linear relationship between voltage and current, a current density of between $8\mu\text{A}$ and $11\mu\text{A}/\text{cm}^2$ is thought to be optimal. The KT-1 model is designed to maintain the electric current that passes through electrodes approximately constant (Constant Current System) regardless of different examinees' skin resistance values, thereby meeting the above requirement for electric current density. In addition, the recording equipment is designed to maintain the voltage between electrodes approximately constant (Constant Voltage System) regardless of different examinees' skin resistance values.



4.4 Physiological Basis of EDA

Eccrine sweat glands, a type of sweat gland, are said to be directly related to the EDA. Eccrine sweat glands exist in the palm and the sole and are controlled by the sympathetic nervous system. As seen in Figure 7, these [sweat glands] can be regarded as variable resistors in parallel.

4.5 Specific Characteristics of the Skin Resistance Response

Specific characteristics of skin resistance response (SRR) described below indicate that they are suitable as indicators for polygraph testing. (1) SRR is sensitive to stimulation and its response range is wide. (2) Methods of measurement are not too complicated. (3) Because SRR is involuntary, it is difficult to control intentionally. (4) Because of its latency (the time interval between the stimulus presentation and response initiation) and its duration is short,

responses to individual stimuli are easily distinguishable.

4.5.1 Evoked and Spontaneous Response

Responses that appear corresponding to test stimuli are called evoked SRR, and responses that appear in the absence of corresponding test stimuli are called spontaneous or nonspecific SRR (sometimes abbreviated as SSRR and NS-SRR). If conditions of the testing room are satisfactory (e.g. soundproof), spontaneous SRRs usually disappear after several minutes. The reasons given below may be responsible if spontaneous SRRs do not easily disappear. (1) Defects in the testing room (e.g. noises from outside). (2) Examinee's arousal level (the degree of excitement) is excessively high. In the first case move to a quiet room and in the second case, delay the questioning for a while and talk with the examinee in an attempt to relieve his/her uneasiness.

4.5.2 Habituation

After repetitive presentations, a stimulus that evoked a large SRR at the beginning of the question presentation gradually becomes less effective and ultimately disappears. This phenomenon is called habituation.

4.5.3 Arousal Level and SRR

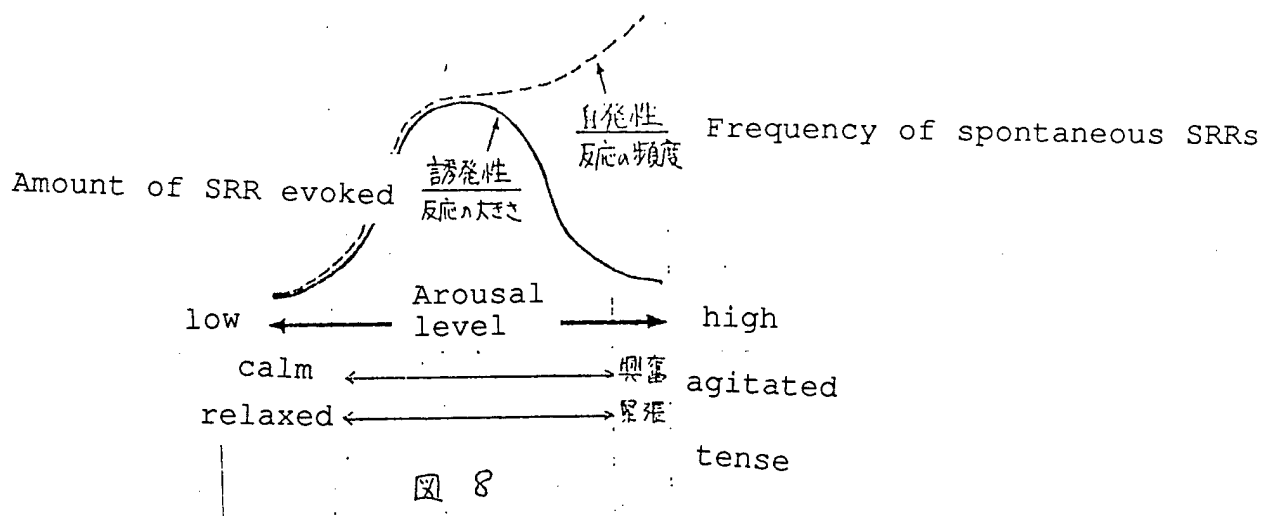


Figure 8 is a graphic representation of the relationship between the arousal level and SRR. When arousal level is too low, SRRs do not emerge easily. If the arousal level is too high, evoked SRRs do not appear easily. At the same time spontaneous SRRs appear so frequently that evoked SRRs become hard to distinguish. Arousal level tends to be low immediately after eating or if the examinee is short of sleep. When the examinee is excessively uneasy, the arousal level may become too high. Attention must be paid to these points when testing. While not indicated in a figure, SRL also relates to the arousal level. Generally speaking, the higher the arousal level, the smaller the SRL magnitude.

4.5.4 Temperature and SRR

SRL and SRR amplitude and frequency are considered to be affected by

(room and skin) temperature. One hypothesis states that if the temperature is too low, SRRs occur less frequently and their amplitude diminishes. The optimal room temperature for obtaining appropriate records ranges between 20 and 25 degrees Celsius. SRR latencies become shorter with rising temperature.

5. Plethysmograms

5.1 What is a Plethysmogram?

A term derived from the Greek word plethysmos (in English, enlargement), the meaning of a plethysmogram is a volumetric change in a body part, caused by blood inflow, measured on the body surface and expressed by electrical or mechanical means as a wave form.

When blood enters an artery from the heart, blood pressure inside the artery rises. Because every arterial wall is elastic as well as expandable, the pressure within a cardiac vessel rises as the heart pumps blood into it. This local expansion within the artery, as well as the rising pressure, propagate throughout the entire arterial system toward the periphery in wavelike fashion. These waves comprise the plethysmogram.

Brown (1967) summarized the characteristics of the plethysmogram as follows: (1) The plethysmogram is a measure very sensitive to changes elicited internally as well as externally. (2) The plethysmogram is measurable at every part of the body; the configuration of control exerted by the nervous system on the part differs in interesting ways depending on the body parts involved. (3) The plethysmogram is resistant to habituation, to the passage of time as well as to repeated presentation of a stimulus. (4) The measure faithfully reflects the activity of the sympathetic nervous system. (5)

Measurement of a plethysmogram requires only simple equipment. The characteristic described in (3) generally in use as a measure of emotion, is lacking in EDA.

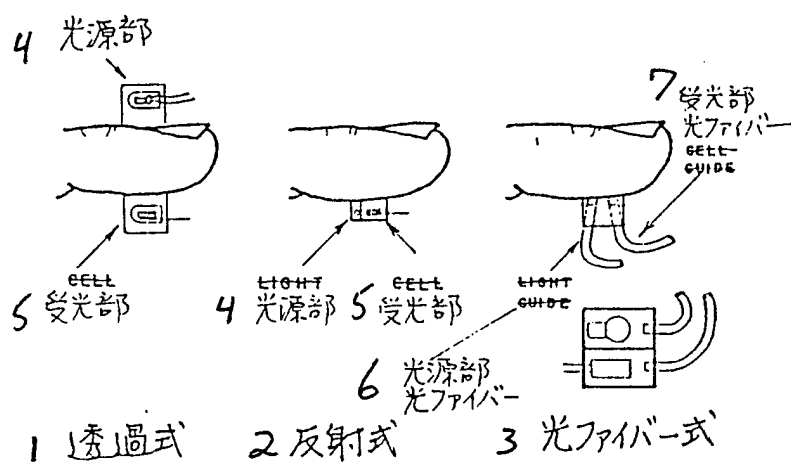
5.2 Emotion and the Plethysmogram

When a person is fearful, the face turns pale and limbs become cold. Everybody has had such an experience in daily life, the response of peripheral vessel contraction elicited by psychophysiological causes. This physiological cause/effect relationship is explained by the process, emotion --> activities of sympathetic nerves --> contraction of blood vessels in the face and limbs. When the blood vessels contract the blood supply to these superficial body parts decreases. As a result, the face looks pale and limbs feel cold because of the decreased amount of warm blood. The plethysmogram is the most suitable index of such responses of cardiac vessels observed (Yamazaki, 1984).

5.3 Plethysmogram Measurement

(1) Photoelectric plethysmograph: The pulsebeat can be observed in a dark room when a fingertip is viewed from the backside by placing a strong light source on the other side. This is the principle of measuring and recording photometric changes of pulsebeat as electric changes. There are two methods. The first is the transmission method, and the second, the reflective method (Figure 1). Both

methods make use of the phenomenon that blood absorbs scattered light when passing through the tissue.



1. Permeation method
2. Reflective method
3. Optic fiber method
4. Light source
5. Light sensor
6. Light source optic fiber
7. Light sensor optic fiber

図1. 光電式容積脈液のセンサー (Brown, 1967)

[Key to Fig. 1: The sensor for photoelectric plethysmogram (Brown, 1967)]

The time constant for the amplifier is chosen depending on what the study aims to achieve. When DC is used for amplification, changes recorded are relatively gradual and reflect the average blood volume of the measured part, expressed as baseline change. When AC is used for amplification, changes recorded are small oscillations that reflect pulse waves passing through the measured part. The former indicates blood volume (BV; blood content, BC), while the latter indicates blood volume pulse (BVP; pulse volume, PV). Figure 2 is an example of simultaneous recording of the plethysmogram at the same body part measured by both AC and DC amplifiers.

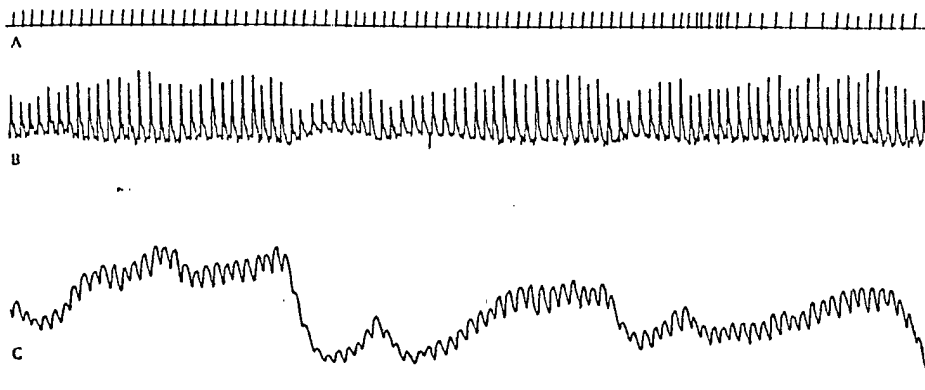


図2. AC増幅(B)とDC増幅(C)で記録した指尖容積脈波。Aは心電図のR波で駆動されたイベント・マーカ (Brown, 1972)。

[Key to Figure 2: Fingertip plethysmogram measured by AC amplifier (B) and DC amplifier (C); A indicates event marks driven by the R wave of electrocardiograph (Brown, 1972)]

(2) Mechanical plethysmogram: In this method, an arm or a fingertip is sealed in a container filled with water or air. Volumetric changes brought about by changes in the volume of circulating blood, expressed as changes in hydraulic or atmospheric pressure, are recorded.

This method has been in use for a long time. Its principle is the most simple and certain. However, procedural complexities from the attachment of equipment to recording, make clinical applications of the method inconvenient (Takagi, 1965).

(3) Impedance plethysmogram: This method attempts to measure the volumetric changes of the body tissue through changes in impedance between two parts of the body when an electrode is attached to each on the skin.

(4) Other methods: Other methods include: Diametric changes of a finger or limb that accompany volumetric changes of the tissue are measured as they are converted into changes in electric resistance; pressure changes that accompany the volumetric change of measured part are measured using a strain gauge. Most generally used is the photoelectric plethysmogram which is simple to handle and has wide applicability.

5.4 Points to Pay Attention to in Measurement

(1) Body parts for measurement: The fingertip is generally preferred. Reasons for the preference include: The fingertip is easy to measure compared to skin surface of other body parts; because of well developed blood vessel distribution and because large plethysmogram amplitudes can be recorded and because a fingertip responds to various internal conditions sensitively, it is suitable for monitoring physiological conditions (Takagi, 1965). With mechanical methods, the fingertip is the only place that measurement is feasible. However, with other methods, measurement is feasible at almost all parts of the skin. While response patterns differ depending on the site on the skin, patterns measured from symmetrical (left/right) parts are almost identical under normal conditions.

(2) Position of measured site: Results differ depending on whether the site chosen is above or below the heart. If the site is higher than the heart, circulating blood flow diminishes; if lower,

congestion occurs. When measuring an examinee seated on a chair, the use of height adjustable arms or the placement of both hands on a table is recommended so that arms are kept at the height of the heart.

(3) Temperature: The room temperature at the time of measurement should be between 20 and 25 degrees Celsius. If the room temperature is below 20 degrees, blood vessels in the skin contract; vessel contractibility diminishes above 25 degrees Celsius. During the season when room and outside temperatures differ greatly, it is desirable to place examines in the testing room at least 30 minutes prior to testing so as to have them adjust to the room temperature.

(4) Age and other factors: Plethysmograms of young persons show considerable variability even in the resting state. Generally speaking, however, plethysmogram variations decrease with age and change little in the aged.

Another problem to pay attention to is the affect of drugs. If a drug that tends to block activity of autonomic nerves, especially of the sympathetic nerves is administered, plethysmogram variability generally decreases and the amplitudes of individual waves increase.

5.5 Measures Used in Polygraph Testing

One of indexes used with the present-day polygraph equipment is the measurement obtained by applying pressure through the cuff attached at

the upper arm at a point between the blood pressures of the expanding and contracting phase. This method actually measures volumetric changes of the arm and heartbeat. They are not real measurements of either the blood pressures of the expanding or contracting phase.

A common standard for judging pulse waves that have appeared in response to a false answer is a rising baseline (Figure 3). The baseline shift of a plethysmogram is considered to reflect increase/decrease in the volume of blood flow caused by changing blood pressure. When an emotive stimulus facilitates activity controlled by the sympathetic nervous system, blood vessels that supply blood to the skin and internal organs contract. Simultaneously, blood vessels that supply blood to skeletal muscles expand. Volumetric increase of upper arm muscle tissues (approximately 85% of this part consist of skeletal muscles), because of increased blood flow, explains at least a part of the rise in cuff-pressure (indicated as rising pulse wave baseline) observed in response to false answers.

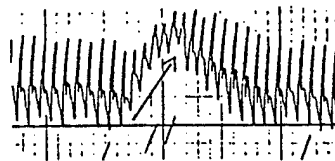


図3 脈波の基線上昇例

[Key to Fig. 3: An example of rise in plethysmogram wave baseline]

The cuff typically is placed at the upper part of the favored arm. The application of a cuff-pressure about 3 mmHg above the diastolic

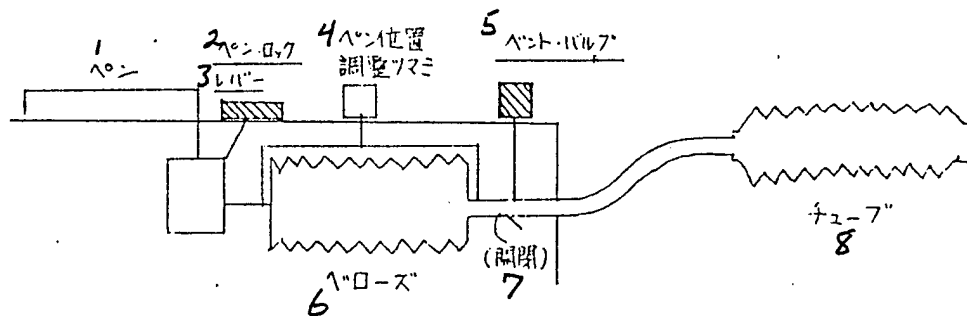
blood pressure is considered to yield the clearest records. The optimum plethysmogram amplitude with the present polygraph equipment is approximately 15 ± 5 mm. The cuff pressure is adjusted in such a way as to have a dicrotic notch fall at approximately the middle of the amplitude. If the cuff pressure is too high, the dicrotic notch falls to the lower part of the wave; if too low, to the upper part.

6. Operation of Test Equipment

6.1 Outline of Mechanisms Used for Each Indicator of Measurement

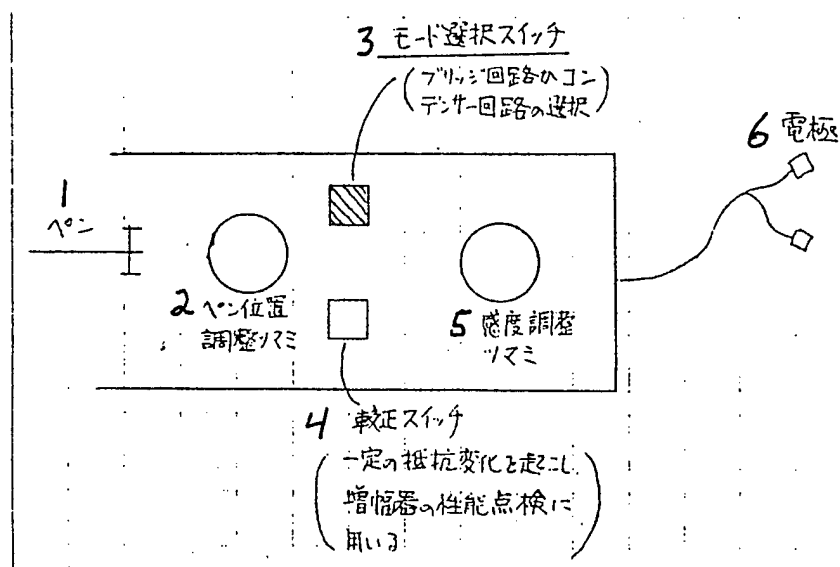
(Underlined switches and other parts in figures in 6.1.1 and 6.1.2 are found only with the Lafayette Polygraph)

6.1.1 Respiration



1. Recording pen 2. Pen lock 3. Lever
4. Recording pen position adjustment knob
5. Vent valve 6. Bellows 7. (Open/close) 8. Tube]

6.1.2 Electrodermal Response

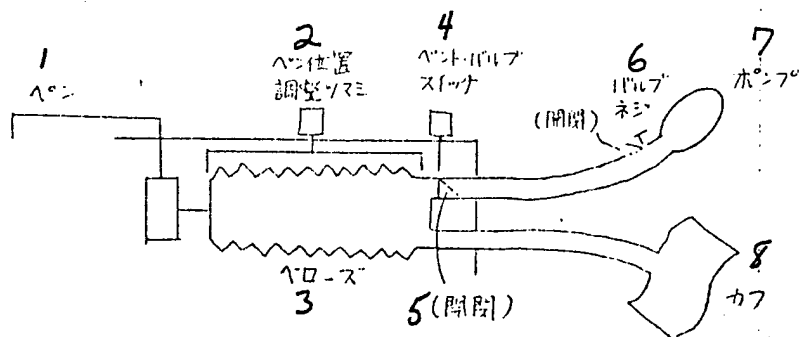


[Keys:

1. Recording pen
2. Recording pen position adjustment knob
3. Mode selection switch (choice between bridge or capacitor circuit)
4. Calibration switch (delivers a constant resistance; used to inspect amplifier)
5. Knob to adjust sensitivity
6. Electrodes]

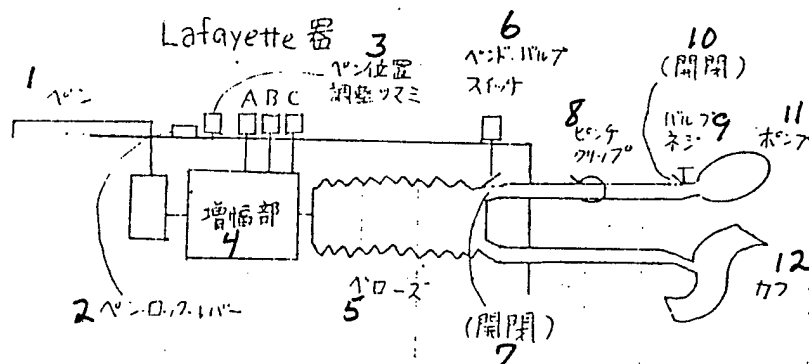
The KT-1 model has a instant switch. When the switch is pressed the line between the electrodes and the main body of the equipment main body is cut. That is, no electric current will flow into the examinee's body.

6.1.3 Plethysmogram



[Keys:

1. Recording pen 2. Recording pen position adjustment knob
3. Bellows 4. Vent valve switch 5. (Open/close)
6. Valve screw (open/close) 7. Pump
8. Cuff]



[Keys:

1. Recording pen 2. Pen lock lever
3. Knob to adjust the position of recording pen
4. Amplifying part 5. Bellows 6. Vent valve switch
7. (Open/close) 8. Pinch clip 9. Valve screw
10. (Open/close) 11. Pump 12. Cuff

- A. Sensitivity adjustment knob--to adjust amplitude size
- B. Response adjustment knob--to adjust changes of baseline
- C. Notch adjustment knob--to adjust notch distinctiveness

6.2 Outline of Operating Procedures

6.2.1 KT-1 model equipment

A. Pretest preparations

1. Confirmation: power switch . . off; GSR sensitivity adjustment knob . . [0]
2. Switch power on
3. Supply ink to recording pen; attach pen to equipment

B. Beginning of testing

4. Turn the recorder switch on
5. Attach the pneumograph tube; adjust respiration records
6. Attach GSR electrodes; adjust GSR records
7. Attach plethysmograph cuff; plethysmogram records

C. Test record Taking

8. Cuff is inflated/deflated for each question series; marking questions and answers

D. End of testing

9. Deflate cuff
10. Place GSR sensitivity adjustment knob at [0]
11. Detach each sensor; turn recorder and power switches off
12. Wash pens with water

6.2.2 The Lafayette equipment

	Power source, etc.	Respiration	GSR	Plethysmogram
A. Pre-test				
1		confirm: vent valve, [open] pen lock lever, [lock]	confirm: sensi- tivity, [0]	confirm: sensitivity, [0]; vent valve, [open]
2	power switch on			
3	supply ink to pen			
B. Begin test				
4		attach pneu- mograph tube	wipe fingers & electrodes with alcohol; apply paste to electrodes; attach electrodes	attach cuff
5		close vent valve; [unlock] pen lock lever		close vent valve & pump's valve screw
6	start paper flow			
7		adjust pen position	adjust sensi- tivity, pen position	inflate cuff; close pinch clip; adjust sensitivity, pen position
8				sensitivity.. [0]; open pinch clip & vent valve; deflate cuff
C. Testing				
9	mark question,			inflate/deflate

answers, etc.

cuff for each
question series

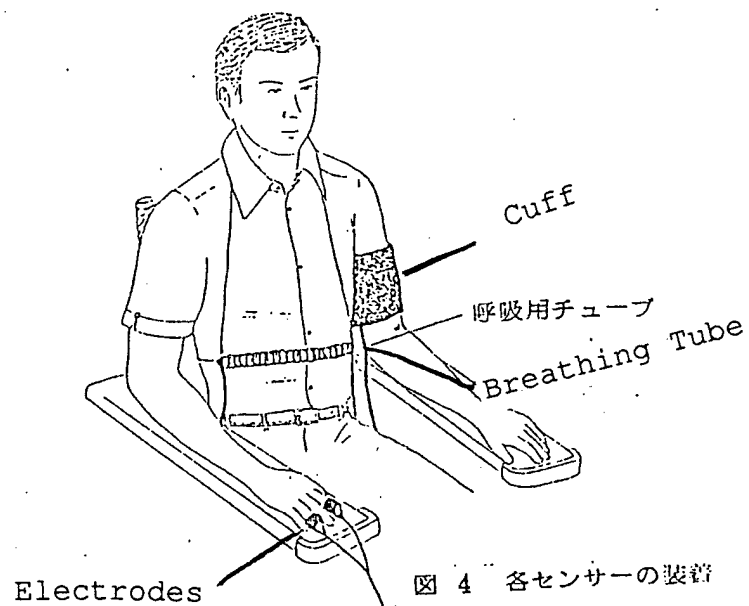
D. Post-test

10	set sensi- tivity, [0]	set sensitivity [0]
11	stop paper flow	
12	[lock] pen lock lever; open vent valve	open vent valve
13	detach pneumo- graph tube	detach electrodes detach cuff
14	power switch off	

6.3 Response Measurement and Chart Marking

- o The cuff is inflated at the beginning of the presentation of a series of questions and is deflated at the end of the series.
 - o Questions are asked at intervals of about 20 seconds. However, when the pen is still oscillating after a GSR, wait until the pen returns to the baseline before asking the next question.
 - o Press the marker button at the beginning of a question and hold it down until the end of the question. Press the button down as the examinee begins answering and let it go at the end.
- At the bottom of the recording sheet, under markings, enter the question number and the type of answer (+, affirmative; -, negative.)

- o Enter the beginning and the end of a question, and the value of cuff pressure on the record sheet. Also mark the sheet when prominent responses occur in response to stimuli other than questions as well as when recording is adjusted during a question series.



[Keys to Fig. 4: Attachment of each sensor

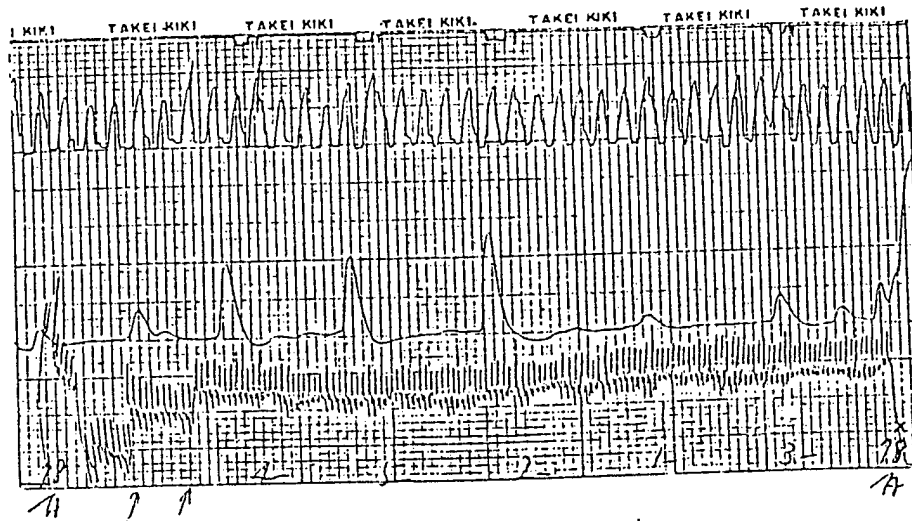


図 10 検査記録列

[Key to Fig. 10: Example of test record]

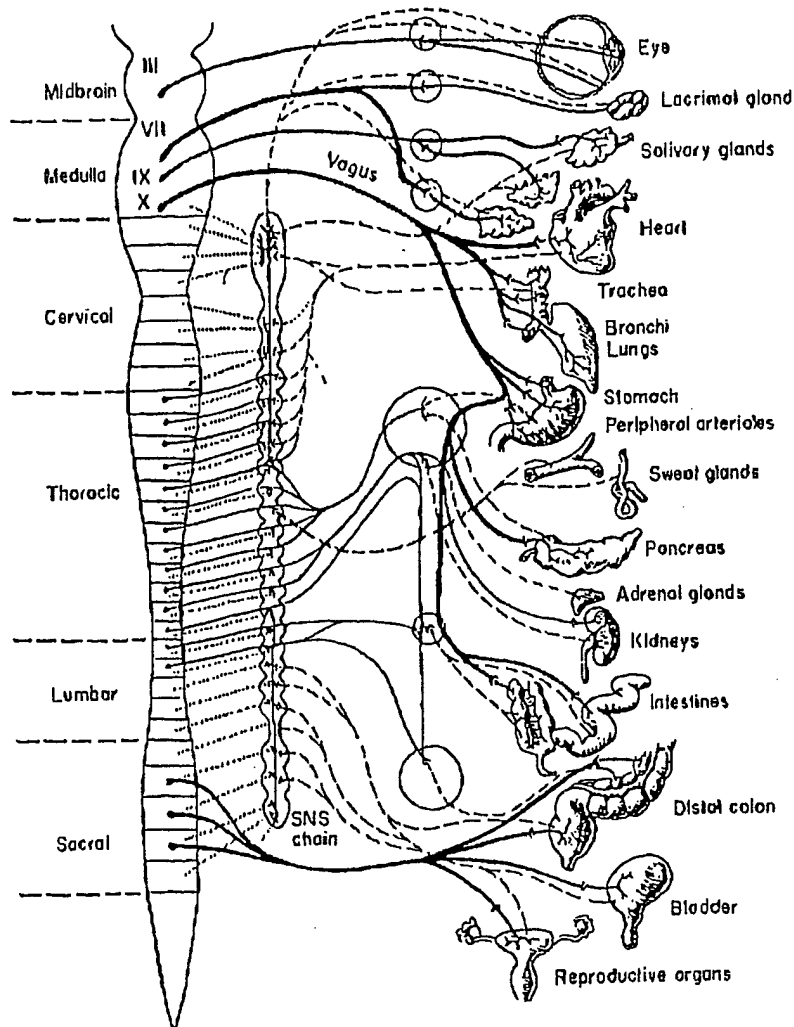
7. Psychophysiology

7.1 What is Psychophysiology?

Psychophysiology studies the relationships between physiological and psychological aspects of behavior. Subjects are human beings for the most part: Physiological responses that appear in response to presentation of stimuli designed to exert influence on mental, emotional or motor behavior are recorded, usually by means of a polygraph. The researcher need not be a psychologist.

Most psychophysiological studies relate to factors that affect autonomic functions: Generally speaking, peripheral effects of autonomic functions are recorded (using a polygraph). Measures used generally include sweating, skin temperature, heart rate, force of heart contraction, blood pressure, and contraction of the stomach (Sternbach, 1967).

7.2 Functions of the Autonomic Nervous System



[Key to Fig. 1: The autonomic nervous system; broken line, the sympathetic nervous system; solid line, the parasympathetic nervous system (Sternbach, 1967)]

Table 1: Principal Excitatory and Inhibitory Autonomic Functions

Structure	PNS effect	Function	SNS effect
Eyes Iris	+	Constriction	-
Lens	+	Accommodation	-
Lachrymal glands	+	Tears	-(?)
Nasal mucosa	+	Secretion, dilation	-
Salivary glands	+	Salivation	-(?)

Gastro-intestinal tract	+	Peristalsis	-
Stomach glands	+	HCl, pepsin, & mucus	0
Pancreas (islet cells)	+	Insulin	0
Heart (rate)	-	Acceleration	+
Lungs (bronchia)	-	Dilation	+
Adrenal medulla	0	Adrenalin	+
Peripheral blood vessels	?	Vasoconstriction	+
Sweat glands	0	Sweating	+
Pilomotor cells	0	Piloerection	+
Internal sphincters			
Bladder }	-	Contraction	+
Intestine }			
Bladder wall }	+	Contraction	-
Lower bowel }			
Genitalia	+	Erection	-

PNS: Parasympathetic Nervous System
 SNS: Sympathetic Nervous System

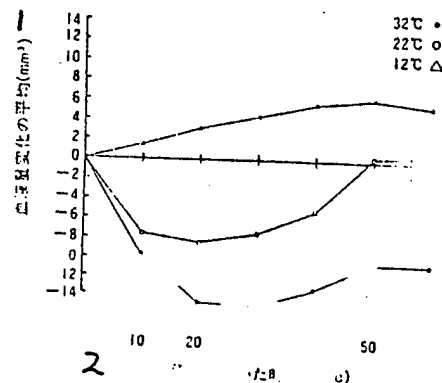
Note: In the table "+" indicates an excitatory effect and "-" an inhibitory effect. Note that the upper portion of the table emphasizes excitatory effects of the cranial parasympathetic, that the bottom portion separates the sacral parasympathetic effects, and that the central portion emphasizes sympathetic excitatory effects.

7.3 Law of initial values (LIV)

The higher the base level of physiological function before the stimulus application, the smaller the response to the function excitatory stimulus. If the base level is extremely high, the stimulus either elicits no response or responses in the opposite direction appear.

Figure 2: Blood volume change to cold pressor at the fingertip. The

curve for a subject tested at 12 degrees Celsius room temperature shows an increase in blood volume at the fingertip; other curves show marked decreases in blood volume for subjects tested at 22 and 32 degrees Celsius (Vallo and Zeiner, 1975).



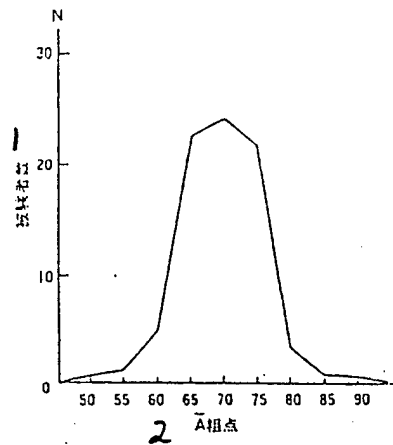
[Keys to Fig. 2:

1. Mean blood volume change (mm³)
2. [illegible]

7.4 Autonomic balance

An individual's achievement and behavior are judged in terms of the person's autonomic balance; that is the degree of relative dominance of either the sympathetic or the parasympathetic nervous system.

Figure 3: Frequency distribution of \bar{A} mean scores (estimates of autonomic balance) for 87 children 6 - 12 years of age (Wenger, etc., 1956)



[Key to Fig. 3:

1. Number of subjects
2. Raw \bar{A} [scores]

7.5 Stimulus Response Specificity

The term refers to patterned physiological responses that appear in response to a particular stimulating situation. That is, the entire configuration of multiple polygraph indicators differs depending on the stimulus; for each specific stimulus a different response pattern appears.

Figure 4: Differing responses of the autonomic nervous system to anger (black bars) and fear (white bars.) Changes in responses measured for different variables are compared to standard values; '+' sign indicates an increase, while '-' sign indicates a decrease. In

the emotional state of anger, the diastolic blood pressure (DBP +,) increases the most, heart rate decreases (HR -,) frequency of skin electric response increases (#GSR,) and muscular tension increases (MT +). In the emotional state of fear, the maximum change is seen in increased skin conductance (C [illegible]); frequency of the peak muscular electric potential [not clear] increased ([illegible] P), and respiratory rate also increased (RR +) ([name of the author and the year of publication illegible.]

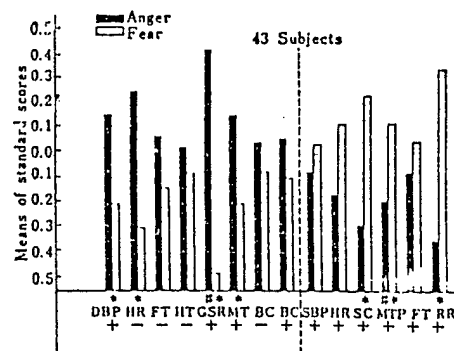
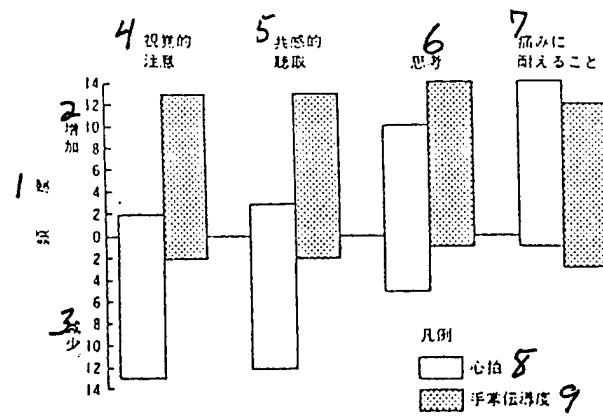


Figure 5: "Direction of response" depends on differing stimulating situations presented to subjects (Lacey, 1959)



[Keys to Fig. 5:

1. Frequency 2. Increase 3. Decrease
4. Visual attention 5. Sympathetic listening
6. Thinking 7. Pain endurance
8. White bar; heart rate
9. Black bar; palm conductance

7.6 Individual response specificity

The term refers to the fact that individual subjects respond to the majority of stimuli in their own characteristic ways. Some subjects show their greatest reaction only in their electrodermal resistance, no matter what the stimulus may be, while other indexes show little change: other subjects' greatest change may occur in heart rate in response to any stimulus. That is, there is a specific response pattern for each individual, regardless of the stimulus type.

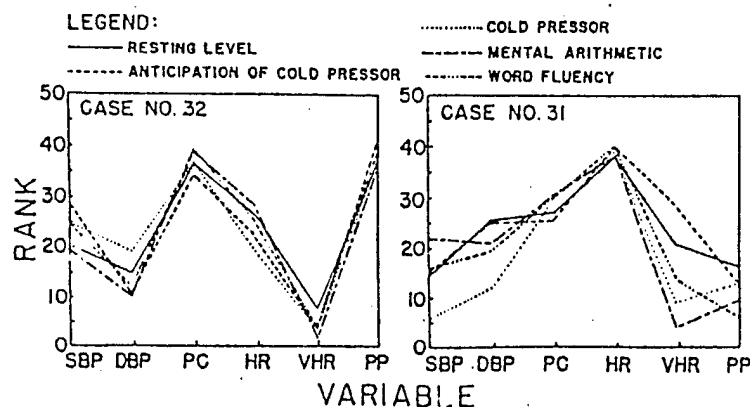


Figure 6: Comparison of two subjects' response patterns to four different stressing stimuli. The horizontal axis indicate systolic blood pressure (SBP), diastolic blood pressure (DBP), palm conductivity (PC), heart rate (HR), and changes in heart rate (PP) (Lacey and Lacey, 1958).

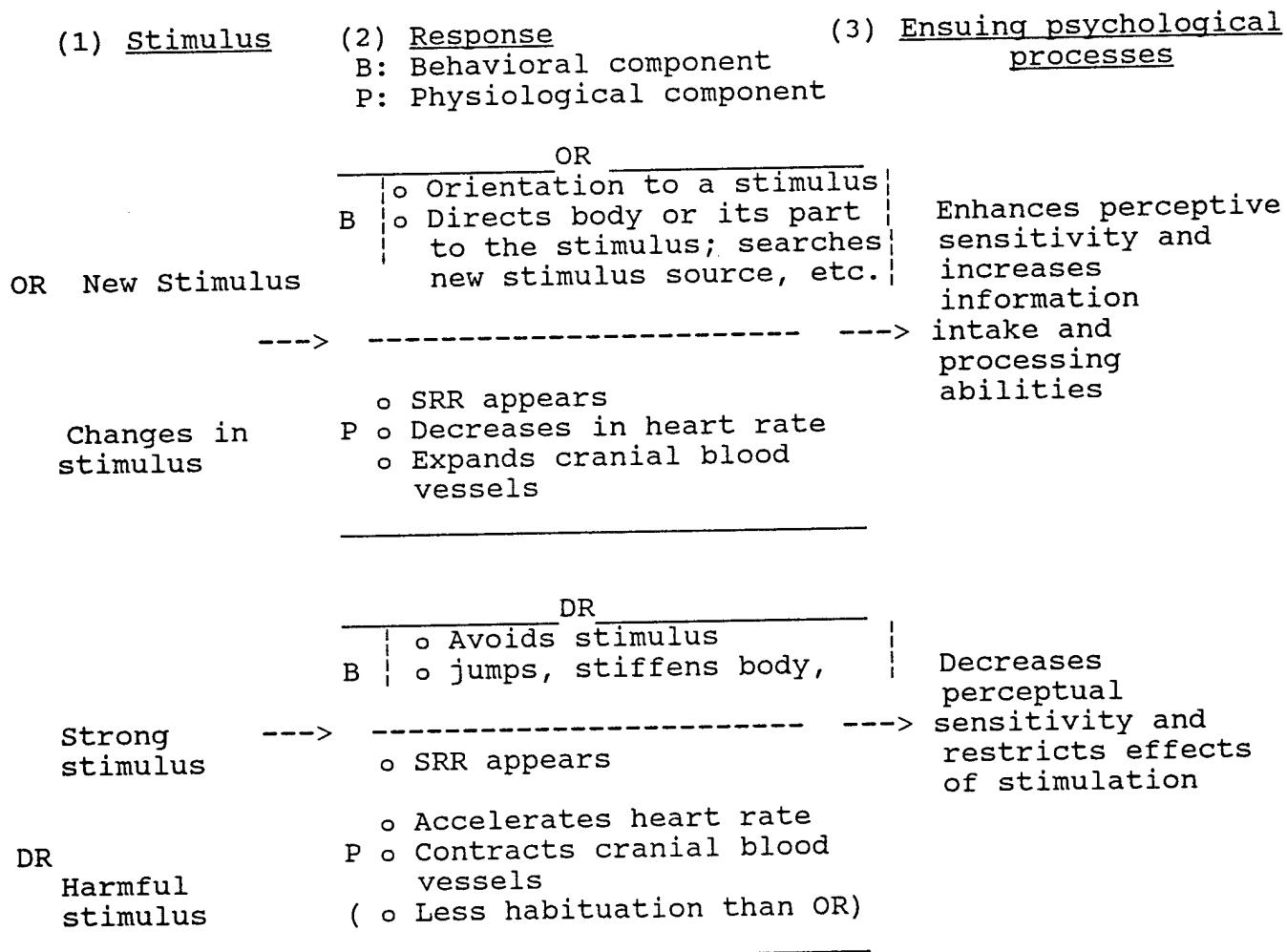
7.7 Orienting Response and Habituation

7.7.1 Orienting response and defensive response

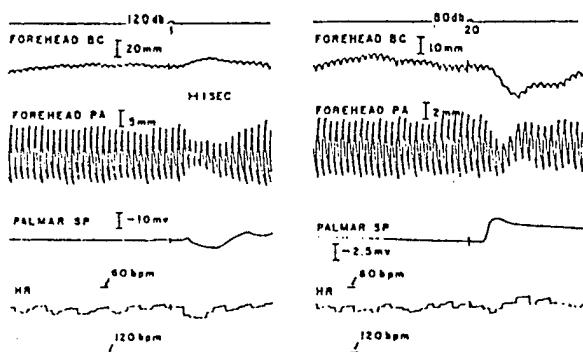
Study of the orienting response (OR) began with I Pavlov's observation that sudden stimulation temporarily suppressed conditioned responses. E. N. Sokolov⁽¹⁾ made a distinction between the OR and the defensive response (DR), thereupon developing a theoretical system. According

to Sokolov, OR and DR are characterized by three aspects: eliciting the stimulus, responses to the stimulus, and the effect of the response on psychological processes that follow. The figure below illustrates the theory.

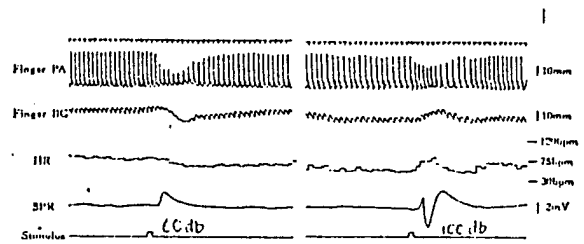
Figure 1



7.7.2 An Experiment on the Distinction Between the Orienting and the Defensive Response OR and DR elicited by sound

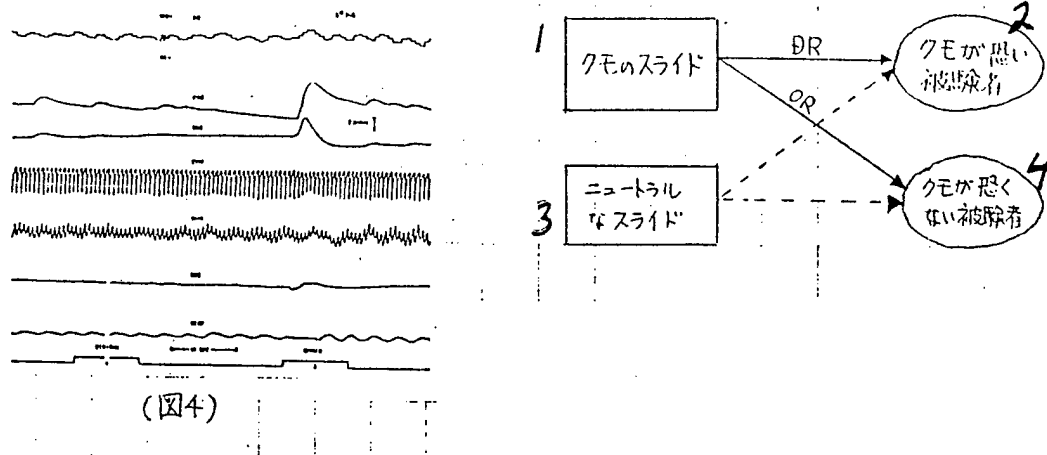


(图 2)



(图 3)

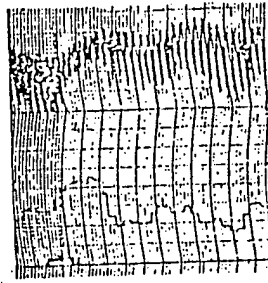
D.C. Raskin and others² performed an experiment in which sound stimuli of 80 db and 120 db were used to elicit OR and DR respectively. The experiment proved that Sokolov's prediction, that OR and DR respectively bring about expansion and contraction of cranial blood vessels, were not necessarily true (cf. Figure 2). A similar experiment by Yamazaki and others³ discussed OR/DR and their physiological counterparts (cf. Figure 3).



Individual differences in OR and DR

1. Slide that shows [a] spider
2. Subject who is afraid of spiders
3. Neutral slide
4. Subject who is not afraid of spiders

Using the experimental design above, R. D. Hare⁴ showed that the same stimulus elicits OR with some subjects and DR with others. Figure 4 is an example from response records of a subject who is "afraid of spiders."



(图5)

OR and DR in lie detection

According to Raskin⁵ DR appears in response to relevant question in CQTs (Control Question Test), while OR appears in GKTs (Guilty Knowledge Test). Figure 5 is an example of an actual response record when a relevant question is presented in CQT.

7.7.3 Habituation

(Cf. Mitsuhashi and others⁶)

A stimulus may elicit a large response at its first presentation but responses diminish with repeated presentations and eventually

disappear. This phenomenon is called habituation.

Principal characteristics of habituation

o Spontaneous recovery: When repeated presentation ceases, the response recovers spontaneously.

o Dishabituation: A response habituated to a specific stimulus reappears when another stimulus is presented.

o Generalization: The habituation effect toward a stimulus generalizes to other stimuli.

Principal factors responsible for habituation

o Stimulus test interval: The shorter the interval, the faster habituation sets.

o Stimulus intensity: Habituation appears quickly and prominently to weak stimuli; very strong stimuli cause no habituation.

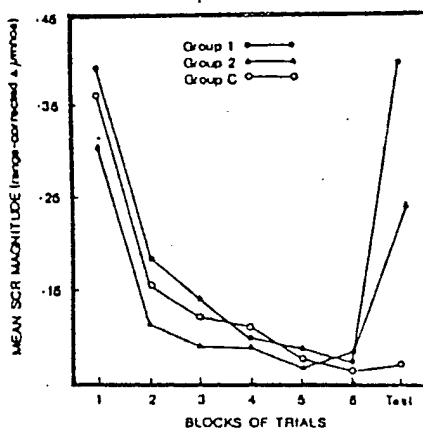
o Stimulus presentation time affects habituation.

Theory on habituation

Sokolov originated one "model theory" concerning the OR and

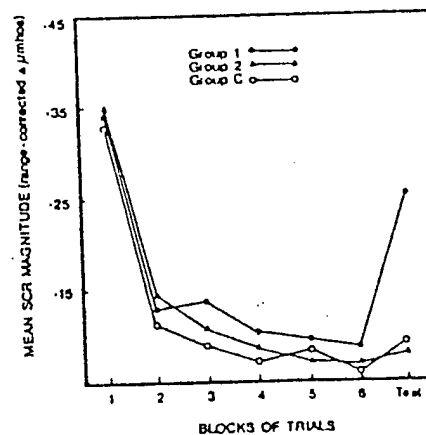
habituation. According to the theory, a model (representation of the stimulus) is formed in the brain as the result of repetitive presentation of a stimulus and is compared to the next stimulus. OR occurs when these are not identical; when they are identical, habituation takes place.

Habituation to verbal stimuli and OR in response to stimulus change



[Key to Figure 6:

	1	2	6	Test
Group 1	Peace	Peace	Peace	Bedcover
Group 2	Pillow	Pillow	Pillow	Bedcover
Group C	Bedcover	Bedcover	...	Bedcover	Bedcover]

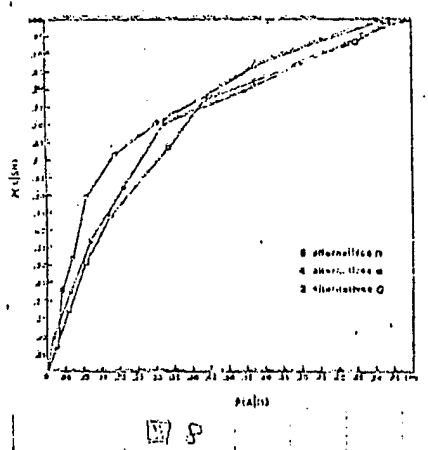


[Key to Figure 7:

	1	2	3	4	5	6	Test
Group 1	Isuzu	Mitsubishi	Toyota	Honda	Daihatsu	Nissan	Tokyo
Group 2	Kobe	Fukuoka	Osaka	Yokohama	Nagoya	Sapporo	Tokyo
Group C	Tokyo	Tokyo	Tokyo	Tokyo	Tokyo	Tokyo	Tokyo]

Siddle and others.⁷ presented stimulus words such as in the tables above one by one and measured corresponding SCRs (Skin Conductance Response). SCRs that appear in response to test stimuli for Group 1 and 2 in Figure 6 are ORs to stimulus change, the magnitude of which is proportionate to the semantic difference between the test stimulus and the one preceding it. SCRs that appear in response to test stimuli 1-6 of Group 1 and 2 in Figure 7 indicate generalized habituation. However, with Group 1, prominent ORs appear in response to test stimulus in a different category.

Information detection and habituation



Placing subjects under no incentive, Ben-Shakhar and others.⁸ use card tests that require no answer to a question. According to their dichotomization theory, response habituation to critical and to noncritical questions during the course of information detection

proceed independent of each other: In addition, habituation generalization is said to occur to different noncritical questions. From this hypothesis the prediction follows that the higher the ratio of noncritical questions to that of critical question, the more rapidly habituation to noncritical questions over critical questions occurs. This results in better detection. Experimental results of Liebrich and others⁹ (Figure 8) which show that when there are more noncritical questions, detection score is better support the above prediction.

7.8 Level of Arousal

Various levels of arousal to activities take place, ranging from a state of barely being awake to extreme excitement. This variable is called level of arousal.

7.8.1 Physiological Index of Arousal Level

In the figure below (Pinneec, L.R. and others.¹⁰), the degree of muscular tension (horizontal axis) are assumed to correspond to the arousal level. The rising arousal level parallels with rising SCL (falling SRL) as well as increases in the heart rate and respiratory rate. And with a higher level of arousal comes a greater frequency of spontaneous SRR.

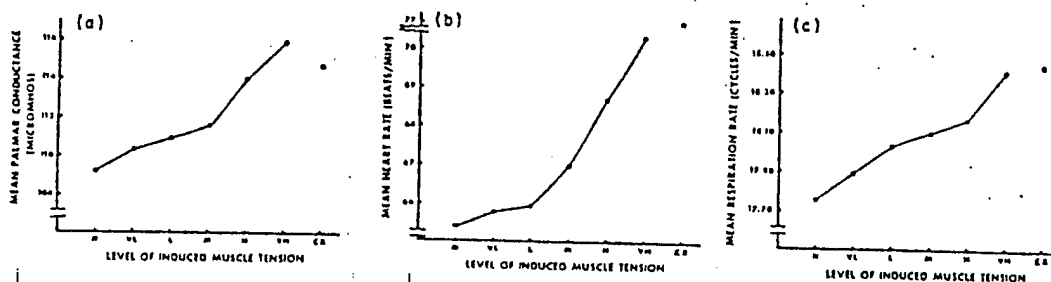


Figure 10

7.8.2 The Level of Arousal and Performance

Wood and others¹¹ made their subjects perform tasks (matching numbers or shapes) at various levels of muscular tension, which is considered to correspond to the level of arousal. The results are in Figure 11. The higher the arousal level, the higher the heart rate. The best performance is obtained at a medium level of arousal; at higher or lower level, the performance worsens. This reverse U-shape relationship between the arousal level and task performance is called the "Yerkes-Dodson Law." However, this reverse U relationship does not hold true in every situation. According to Hebb, D. O.¹², the optimum level of arousal differs for each task, depending on its nature (cf. Figure 12). "A" is a long-practiced simple task. "B" is

a task that requires complicated and skilled movements. "C" is a task that, while uncomplicated, demands full mobilization of effort for its performance.

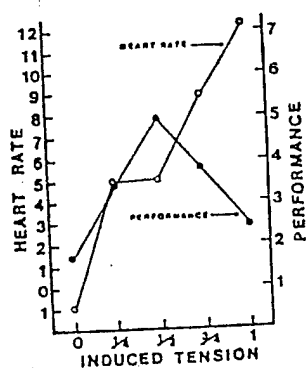
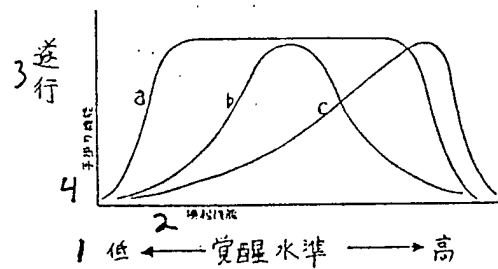


Figure 11

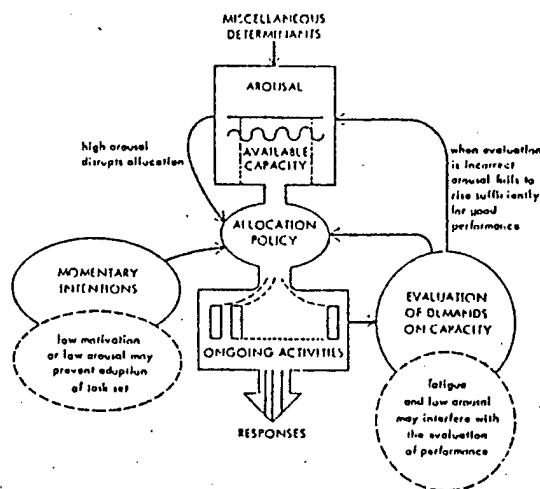
Kahneman, D.¹³ explains the "Yerkes-Dodson Law" using the model in Figure 13. When the arousal level is too low, the subject cannot adopt a task set. Such a subject also fails to evaluate the quality of his/her own performance. On the other hand, when the arousal level is too high, the subject fails to achieve a proper distribution of attention.



(図 12)

[Keys to Fig. 12:

1. Low <--- Arousal level >---> High
2. Arousal function
3. Performance
4. Cue function



(図 13)

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- (2) Raskin, D.C. Kotses, H., and Bever, J. Psychophysiology, 1969 (6) 149-159.
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8. Peak of Tension Test

The Peak of Tension Test (POT) can be classified as follows:

Examiner knows the critical item . . . Known Solution (KS)-POT
POT-Examiner does not know the critical item . . . Probing (PR) or
Searching (S) POT, card test

The KS-POT is explained below.

8.1 Question Contents

8.1.1 Collecting Material for Questionnaire Development

Several information sources described below can provide material for questionnaire development: (1) Records of observations about the scene of the crime; (2) case records (notice of damage, investigative report, and depositions, on-site photographs); (3) explanations provided by the investigator; (4) victim testimony, etc. Question materials consist of material obtained from the above sources minus the examinee's knowledge of the crime. Attention must be paid to information often transmitted to examinees via the mass media, persons connected with the crime scene, or the investigator conducting the interrogation. Also information that cannot be confirmed objectively should not be asked about. For example, subjective judgments such as "beautiful," "big," or motive for the crime cannot be incorporated

into questions.

8.1.2 Question Content and Memory

A critical item is meaningless if the criminal does not recognize it. Even the criminal himself/herself has not necessarily perceived or memorized every bit of information concerning the crime. Therefore, in developing a questionnaire, the examiner must guess what types of information a criminal will remember well.

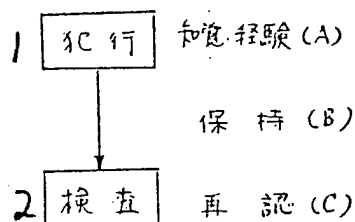


図 1

[Keys to Fig. 1:

1. Crime committed
2. Test
- (A) Perception/experience
- (B) Retention
- (C) Recognition

As seen in Figure 1, the time span from the time at which a crime was committed to that of polygraph testing can be roughly divided into three stages, A, B, and C, in regard to the criminal's perception and memory of the crime. The following are points that should be regarded in preparing questions concerned with each of these stages. (A) To begin with, the criminal may not have perceived the object. For example,

"number of stolen bank notes" and "color" often fall into such a category. Further, if the criminal was drunk at the time of crime, the possibility is high that objects were not perceived. (B) Generally, the longer the time between perception and recognition the more will be forgotten. However, the cause of forgetting is more attributable to interference from similar events occurring during the period of retention than to passage of time itself. If the examinee has repeatedly committed similar crimes, a high probability will exist that his/her memory has been interfered with even if he/she in fact happens to be the actual criminal responsible for the crime under investigation. In such cases, it is necessary to devise a test in such a manner that the examinee can identify the events of the particular crime. (C) Occasionally even if the examinee has retained particular information, he/she may not be able to recognize it. One method for preventing such occurrences is to formulate questions that make each question unique, keeping dissimilarity with other questions uniformly great.

Next, the characteristics of memory are discussed for different question contents. Generalized, rather than detailed, information, information accompanied by an act or action, rather than merely based on perception, and emotionally-tinged information tend to be better memorized. However, it should be noted that probability of retaining emotionally-tinged information will likely not be high. Intentional or planned actions, on the other hand, are especially well retained. On the other hand, colors and items kept in containers are often not

perceived or memorized.

8.2 Development of Questions

8.2.1 Number of Questions

A list of questions consists of one critical and four to six non-critical questions. There should be five or more questions per list. Drawbacks of having too small a number of questions include: It then becomes easy for even an examinee who has nothing to do with the crime to guess which question is the critical one; the probability that a critical question will inadvertently elicit specific responses becomes higher; intraseries shifts of response pattern toward the critical question become harder to detect. While some experiments indicate that the rate of detection improves when there are more questions, undesirable factors also emerge, such as examinees becoming bored or pained by the testing. Therefore, the appropriate number of questions is considered to be between five and seven.

8.2.2 Question Selection

"Those who are innocent of the crime cannot discern which question is the critical one." This is the basic condition that POT questionnaires must meet. The procedural condition requires that an "examinee innocent of the crime will not respond specifically to the critical question."

The following types of question construction must be avoided when developing questionnaires: (1) Some non-critical questions appear impossible to innocent examinees, so they cannot be considered critical questions. For example, Table 1 lists places where the criminal could have entered the premises. Actually there are no windows in the living room and bedroom of the victim's house. Question Number 1 and Number 5 are inappropriate as non-critical questions for those examinees who know the victim's house well, leaving Table 1 with only three functional questions. (2) Regardless of its relevance to the crime, one particular question turns out to be relevant or liable to arouse emotional reactions in the examinee. For example, if a name of a person, whose affiliation with the examinee is strong is included in a list of names or a specific question alone no matter if it is a critical question or not. (3) Dissimilarity among questions is not uniformly great. For example, take Table 2 that lists stolen goods. Items Number 1-3 and Number 5-6 belong in the same category in the sense that all are made of metal with little difference in value. Number 4, cash, is dissimilar from others. Whether Number 4 was or was not the critical item, specific responses to it might appear. Among questions about color in Table 3, in which Number 4 is the critical question, Number 2 is the only one similar to it. A probability exists that Number 2 will elicit specific responses that might interfere with interpretation.

Table 1.

1. Livingroom window

Table 2

1. Radio

Table 3

1. Brown

- | | | |
|----------------------|-----------------|-----------------|
| 2. Kitchen door | 2. Necktie pin | 2. Yellow green |
| o 3. Bathroom window | 3. Wrist watch | 3. Blue |
| 4. Entrance door | 4. Bill | o 4. Green |
| 5. Bedroom window | 5. Lighter | 5. Red |
| | 6. Fountain pen | |

Within the framework described above, as "rough" as possible question development is desirable to achieve a high rate of detection. In a case of "money stolen from a coffee shop named Refrain," the tree in Figure 2 represents degree of "roughness" in developing questions about the site of the crime. If the examinee knows that the "crime was committed in a coffee shop", "detailed" questions must be at level C; namely, (1) Renoir, (2) Italian Tomato, (3) Refrain, . . . If the examinee knows only that the "crime was committed at an eatery," questions should be at the rougher level B; namely, (1) a snack bar, (2) a tavern, (3) a coffee shop . . . Further, if the examinee says he/she knows nothing about the crime site, questions should be at level A; namely, (1) a company, (2) a school, (3) an eatery . . . If one considers that the concept each question represents is too wide so that the examinee has difficulty envisioning a concrete image, questions may be about (1) an insurance company, (2) a high school, (3) a coffee shop . . .

[Key to Fig. 2:

(A)

Company

(B)

Insurance company

(C)

"Renoir"
"Italian Tomato"
"Refrain"
"Miami"
"Satin Doll"

Coffee shop

Snack bar

Eatery

Tavern

Western-style restaurant

Japanese-style restaurant

School

High school

Hospital

8.3 Form of questions

Expression: A question must be expressed so as to take into consideration the examinee's knowledge and vocabulary. For example, for an examinee who is visually familiar with a "vest," but does not know that it is called "vest," "vest" as part of a question would be meaningless. However, difficulties of this sort can be taken care of by reading each question to the examinee and, if needed, by explaining to him/her what the term means.

Written questions: Questions should be as concise as possible. If a written question is long and hard to comprehend, physiological responses that accompany an examinee's mental activity associated with his/her effort to understand it may interfere and make evaluation difficult. The manner of asking questions must stay uniform within the same question series, but may vary between series of questions;

e.g. "was it . . . ?" for the first series, "Do you know the stolen item is . . . ?" for the second, and "Did you steal . . . ?" for the third.

When a question represents something difficult to express verbally, e.g. color, shape, or relative positions, visual presentation is effective, using figures, photographs, or the real object.

One question should not contain more than two question items.

8.4 Presentation of Questions

8.4.1 Order of Presentation of Question Lists

Methods of presentation generally in use include: first presenting the list to which the criminal is expected to show prominent specific responses; to present question lists according to the order of acts that took place at the time of crime. Attention must be paid so that the examinee cannot guess from the contents of the previous list which question in the subsequent list is the critical one.

8.4.2 Reading Questions Before Question Presentation

Before testing, the examinee is asked if he/she recognizes contents of each question, confirming that the answers to them will be negative. Namely, make certain that the examinee will answer "I don't know" to

such questions as "Do you know the place where the criminal entered?" or "What was stolen?" If the examinee's answer is positive, ask for the source of the knowledge. This procedure is necessary, because the examinee might have received the information from sources unknown to the examiner at the time of question development. When during the process the examinee reveals that he/she is not aware of information reported in the mass media, this content can be used within a question. (The evaluation of 'no recognition' can be made positive using questions developed following procedures described above. However, when specific responses appear to the critical question, it is necessary to check following testing where the examinee has gained the knowledge. An innocent examinee who has knowledge of the crime may have answered "I don't know" out of fear that he/she may come under suspicion, if answering in the affirmative).

Following the notification of question contents and before the actual presentation, three cases (A, B, and C) are conceivable as shown in Table 4. Generally case A is not adopted, because prenotification of questions has the following merits (purposes).

- o As stated previously, it is possible to make certain that the examinee will answer in negative to each question.
- o It is possible to make certain that the examinee understands the meaning of each question; if it is difficult to understand, explanation can be provided.

Table 4

Notification of questions	Notification of the order of questions
A	---
B	x
C	x

According to experimental studies, no difference exists between methods A and B as to rate of detection. Comparison of methods B and C shows that with B examines are more "surprised" at the presentation of the critical question and find it more difficult to interfere with the testing than with C. On the other hand, spontaneous responses, the factor that makes evaluation difficult, occur more frequently with B than C. According to experimental studies, rate of detection is higher with B than C.

8.4.3 Question Series

Each questionnaire must be presented three or more times. Generally, questions in the second series are presented in reverse order (descending order) from the first series (ascending order). After the third series, questions are presented in a different order (random

series) from earlier series. Repetitive presentation aims at achieving effects described below. (1) To reduce the chance of accidental occurrences of specific response to critical question. (2) To confirm the occurrence of specific responses. It is difficult to determine after only one series if specific responses did or did not appear. (3) To make evaluation easier by habituating disturbing responses that stem from excessive arousal.

The first question at the beginning of a question series should not be a critical question. Initial responses (orientation responses to the fact that questioning is about to begin rather than to question contents) occur to the first question in the series. Also, critical questions should not be at the end of the series. Responses to the fact that question series has come to an end tend to appear. In addition, responses to the question at the end cannot be compared with those to other questions in the middle of the series to detect changes in response patterns.

The position of a critical question within a series should vary from one series to another. If a critical question is always presented at the same position, even an examinee who does not know the facts may easily be able to guess which is the critical question. Even when specific responses appear, they can be interpreted as in response to the same presentation order rather than to the content of the critical question.

8.4.4 Method of eliminating monotony

(1) Present a question that requires an affirmative answer at the beginning or at the end of the question series.

Some examinees may resort to deception and answer mechanically in the negative as soon as they hear a voice, without listening to what the question asks. This method helps to prevent such incidents as well as to determine if such an act is being practiced. In addition, this method is considered to be effective in breaking response habituation, thereby restoring diminished responsiveness. However, such a question should not be presented in the middle of the question series.

(2) Change the style of speech each time a new series starts.

This method is effective in breaking response habituation, prevents boredom, and maintains examinee's attention toward questions as well as his/her responsiveness. The style of speech should not change in the middle of a series.

(3) Ask to recall questions at the end of the question series.

If an examinee is resorting to deception as described in (1,) recalling is almost impossible. Therefore, the method provides a means of determining if the examinee has practiced deception. Some experimental studies have found that a positive correlation exists

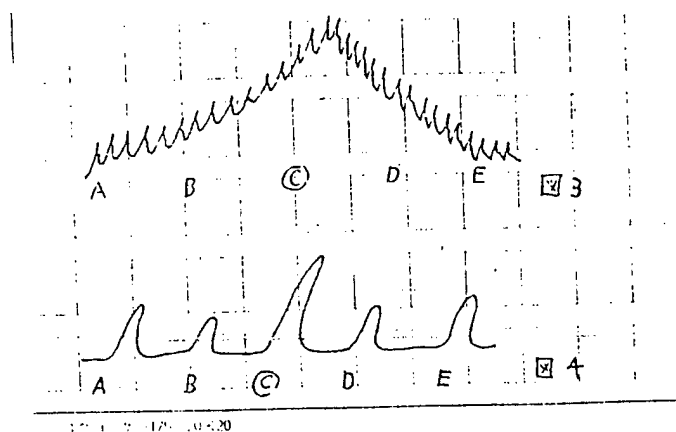
between the quantity of question recall and the rate of detection.

(4) Provide a short rest period: (5) Hold a midtest interview.

These methods bring about spontaneous recovery of responses. And they are effective in preventing boredom, reducing fatigue, and maintaining attention to question as well as responsiveness.

8.5 Guilty Knowledge Test: GKT

The GKT used by American researchers and the POT practiced in Japan can be regarded the same. Different names, POT and GKT, come from different views of specific response emphasized by Keeler and Lykken, who respectively devised POT and GKT. Keeler emphasizes changes of response pattern within a series which reaches its peak at the critical question, namely a tonic change, as is seen in Figure 3, as the representative specific response. Lykken, on the other hand, pays attention to phasic magnitudes of responses as in Figure 4. Both are necessary in the evaluation of the "POT."



9. Examples of Points to Pay Attention
to in POT Question Development

9.1 Points to Pay Attention to in POT Question Development

9.1.1 In principle, five to nine questions constitute one question series, i.e., in addition to one critical question a series includes four to seven noncritical questions.

Because they do not satisfy the above condition, the lists below are inappropriate.

Example 1 (theft)

1. Did you know that the stolen envelope contained a sales slip?
2. a check? (critical question)
3. a savings book?
4. a seal (critical question)?
5. a bill?

Example 2 (theft)

1. Did you know that the criminal left a hat at the scene of the crime?
2. a windbreaker? (critical question)
3. a pair of sandals?
4. a towel? (critical question)

5. a pair of rubber boots?
6. a screwdriver?

Example 3 (arson)

1. Did you know that the criminal sprinkled oil to ignite a fire?
2. broke a wooden wall? (decisive question)
3. opened the cock of an LP [liquid propane] gas container?
4. used straw? (critical question)
5. used newspaper?

Example 4 (theft)

1. Did you know that the criminal stole sake [rice wine]?
2. a clock?
3. panties? (critical question)
4. stocks?
5. cash? (critical question)
6. gift certificates?
7. a camera?

Example 5 (murder)

1. Did you know the victim was a woman with long hair?
2. with short hair? (critical question)
3. Did you know that the victim died wearing a kimono?

4. naked? (critical question)
5. had a bath towel wrapped around her
hip?

Example 6 (theft)

1. Did you know that the cash was in a large envelope?
2. medium-sized envelope?
3. small envelope? (critical question)

9.1.2 Conditions that regulate the content of critical questions are given below.

1) Question content must consist of information that has a high probability of being recognized by persons related to the crime.

Because the question lists below do not satisfy the above condition, they cannot be considered appropriate.

Example 1 (theft)

1. Did you know that 52,000 yen in cash was stolen?
2. 54,000 yen?
3. 56,000 yen? (critical question)
4. 58,000 yen?
5. 60,000 yen?

Example 2 (rape)

1. Did you know that while raping the woman the criminal said "Don't tell the police"?
2. "You are pretty"?
3. "Don't tell your father"? (critical question)
4. "How old are you?"
5. "You have good-sized breasts"?

Example 3 (murder)

1. Did you know that there was an apple on the table in the victim's room?
2. Coca Cola?
3. noodles? (decisive question)
4. juice?
5. rice?

Example 4 (murder)

1. Did you know that a "Masashi Sada" poster was pinned on the wall of the victim's room?
2. "Ryudo Uzaki?"
3. "Yosui Inoue?" (decisive question)
4. "Ryuichi Sakamoto?"
5. "Ayuo Takahashi?"

2) The question content must contain some detailed fact concerning the crime under investigation that is not widely known.

3) The critical question should not easily be guessed as such with a high probability by examinees not related to the crime.

Example 1 (burglary)

1. Did you know that when the criminal entered the house,
the place was lit up?
2. only one fluorescent lamp was on?
3. pitch dark? (critical question)
4. only the kitchen light was on?
5. had exterior light on?

Example 2 (hit and run)

1. Did you stop at the sight of a parked ambulance on **
Street where there was an accident on the ** th [date]?
2. at the sight of a crowd gathered
there?
3. thinking you hit someone?
(decisive question)
4. at the sight of policemen directing
traffic?
5. at the sight of a car that appeared
to have been in an accident?

Example 3 (hit and run)

1. Did you get a new fender rear-view mirror because the
old one was stolen?
2. someone bent it?

3. it was broken in a traffic accident?
(critical question)
4. it was old?
5. a new design product was recommended?

4) Even if an item is a detailed fact concerning the crime under investigation, an expression that has a danger of evoking a rather strong emotion in the eyes of a third party should not be used as part of a critical question.

Example 1 (murder)

1. Did you know that the woman victim was killed wearing a negligee?
2. naked from the waist down?
3. stark naked? (critical question)
4. naked above the waist?
5. wearing panties only?

Example 2 (rape)

1. Did you know that the criminal made the victim take her clothes off by threatening her?
2. by ripping buttons off?
3. by lifting her skirt?
4. by tearing her clothes into shreds?
(critical question)
5. raped her leisurely after rendering

her unconscious?

5) Regardless of whether or not the examinee has something to do with the crime under investigation, contents that strongly relate to the examinee's ego should not be used in critical questions. This type of question list often takes the form of probing questions.

Example 1 (theft)

1. Was a screwdriver used to pry open
the door to the company?
2. in your house?
3. in your car?
4. in the company garage?
5. picked up on a street?

Example 2 (theft)

1. Do you think that the person who stole the cash from
[Mr/Ms] **s purse is Mr/Ms Kawaguchi?
2. Takagi?
3. you?
4. Yamada?
5. Kawasaki?

Example 3 (theft)

1. Did your girlfriend Masako steal the camera in her room?
2. Did you steal the camera in Masako's room?

3. Did somebody else steal the camera in Masako's room?
4. Did someone ask Masako to keep the camera in her room?
5. Did someone ask you to keep the camera in Masako's room?

9.1.2 [sic; 9.1.3?] The following conditions govern the content of noncritical questions.

1) The same concepts apply to the information contained in noncritical questions as to that contained in the content of the critical questions. However, when presented to examinees related to the crime under investigation, they must be able to discern easily contents of noncritical questions from that of critical questions.

The following are examples of inappropriate lists, because they do not satisfy the above condition.

Example 1 (theft)

1. Do you know that the criminal opened the safe by dialing only?
2. using keys only?
3. using keys and dialing? (critical question)
4. the safe has no dial and is not locked?

Example 2 (theft)

1. Did you know that the stolen cash was on the TV?
2. in a desk drawer?
3. in a drawer of the cupboard for the tea set? (critical question)
4. in a drawer of the sideboard?
5. on the kotatsu [a body warming device] table?

Example 3 (theft)

1. Did you know that the stolen item was a handbag that contained a ring and other things?
2. a box that contained sales receipt?
3. a handbag that contained cash and other things?
(critical question)
4. a handbag that contained checks and other things?
5. a cash register that contained sales receipts?

Example 4 (theft)

1. Did you know that the criminal entered the place by breaking the locked door?
2. entered through the bathroom door?
3. ran away when he was discovered as the light was switched on? (critical

question)

4. ran away without entering?
5. Did you know that nobody was in the office?

2) Those who are not related to the crime under investigation, must have a low probability of distinguishing the different meaning or value contained in noncritical questions from that of the critical questions on the same list. However, when presented, critical and noncritical questions must be distinct from each other in content.

Lists below are not appropriate, because they do not satisfy conditions 1) and 2) above.

Example 1 (theft)

1. Do you know that the criminal smashed the safe with a hammer?
2. burned it with a gas burner?
3. found the key and opened it?
(critical question)
4. opened it with an electric drill?
5. blasted it with dynamite?

Example 2 (theft)

1. Do you know that a bank passbook was stolen?
2. a wrist watch?
3. cash? (critical question)

4. a fountain pen?
5. eye glasses?

Example 3 (theft)

1. Do you know that the criminal was observed to hold a leather attaché case in his hand as he exited from the room?
2. a bundle in a cloth wrapper?
3. leather shoes? (critical question)
4. a paper bag?
5. a jacket?

9.2 Specific examples of POT application

1. Cases in which examinees who actually are the criminal do not show specific responses

(1) Cases in which examinees hiding their criminal acts do not know the contents of critical questions

Example 1: The case examined was attempted arson in which several old clothes were bundled together with a piece of straw rope and used as kindling. The critical question addressed the use of kindling. The examinee was a housewife who lived near the site of the crime. No specific responses were observed. However, soon after the start of interrogation, she confessed to the crime. According to the suspect,

the kindling consisted of "old clothes I found about three months ago at the time of a major cleanup and stored in the shed. When I decided to set a fire, I took them out and used them as kindling. Therefore, I don't remember at all what those old clothes were."

Example 2: When the victim was preparing to go home, he noticed that one 10,000 yen bill was missing from the folder where he had placed it together with his driver's license. The folder was in his pants pocket. The pants were in a locker in the locker room.

The critical question asked was: "Was the money placed in the driver license folder?," on the assumption that the criminal would have remembered that the cash was in the folder. No specific responses were recorded. Judging from the statement that the criminal made after confession "the money was in something that looked like a black notebook," it became obvious that he had not noticed precisely what the item was in which he had found the money.

Example 3: The case tested was that of setting afire a car parked on a street. The person who reported the fire first was the examinee, who was recognized to be quite tipsy at the time of notification. A POT list was developed using as critical questions the part of car where the fire had started as well as materials used to set it. No specific responses were observed except for some parts of the questionnaire. According to the examinee after he confessed, because of intoxication, he did not remember any details at the time of

testing, even though he must have seen the items.

Example 4: In the investigation of a burglary/murder suspect, details found at the scene of crime were used as critical questions. Except for in some parts of the questionnaire, no specific responses were observed. The examinee, a former employee of the factory where the crime was committed, was spending the night in an employees' dormitory at his strong request.

The examinee soon confessed to the crime. Making use of his detailed insider knowledge, he guided the man who had actually committed the burglary/murder, giving instructions about where cash was kept and making forced entry. However, he himself was not near the site, nor did he participate in the murder. Therefore, he hardly had any detailed knowledge of the scene of crime.

(2) Cases in which victims provided incorrect information so that inappropriate contents were chosen for the critical question.

Example 1: The examinee, a part time worker at a supermarket, was tested under suspicion of stealing a large sum of cash from a safe which was in the care of an accountant. Based on the statements of victim and others that the accountant left the office between 1 p.m. and 2 p.m., the crime was judged to have occurred during this time period and a critical question was prepared. But no specific responses were observed. However, prominent physiological responses

occurred to one of the noncritical questions, "Do you know that money was stolen between 10 a.m. and 11 a.m.?" According to the examinee's statement after confessing, the time of crime was not between 1 p.m. and 2 p.m., but "around 10:30 in the morning." Although the accountant responsible for the safe was away from the office approximately 30 minutes before and after the real time of crime, because he [she] did not tell the truth, this fact was hidden. Instead, the accountant mentioned the official rest period of from 1. p.m. to 2 p.m.

Example 2: A bar hostess was tested under the suspicion that she stole a large sum of cash after she saw it in the drunken victim's wallet and made a round of bars with the victim with the intention of stealing it. The critical question was based on the victim's statement that approximately 280,000 yen in cash was in the wallet. No specific responses were observed. According to the statement the suspect made after confession, she stole 160,000 yen. Due to intoxication, the victim was unable to make correct judgments and was confused about money spent and what was left in the wallet. Because of this mistake, an incorrect sum was used for the critical question.

Example 3: A suspect in a robbery case that took place in a financial organization was tested. At the time of the crime, the victim was alone in the office to face the criminal. The victim stated in detail the criminal's features and behavior so that abundant materials were available to be used as contents of POT critical questions. For

example, the victim stated that the weapon the criminal carried was "something similar to a double-edged mountaineer's jackknife." This became the content of a critical question. However, no specific responses were observed to the question. According to the suspects's statement after testing, the weapon was "a jackknife, the blade was shaped similar to that of a higonokami [a pencil sharpening knife commonly used by Japanese school children]." The victim was terror-stricken at the time of the crime and acted as the criminal told him to. Moreover, he was in no state to keep his presence of mind and be able to remember precise details later. Nevertheless, he pretended that he had been cool and calm. Because of this pretense, he presented incorrect impressions as facts. Therefore, critical questions had inappropriate contents instead of detailed facts about the crime.

2. Cases in which examinees who have nothing to do with the crime show specific responses.

(1) Cases in which examinees can guess with relatively high probability the contents of critical questions, although they do not know the exact facts

Example 1: A female employee attending a company party had her pay envelope containing over 150,000 yen in cash stolen from her handbag left on a table in an adjoining room. Because only a limited number of people were in and out of the room, several employees were tested.

When the amount of cash in the pay envelope was used as content of the critical question, a female employee responded specifically. Actually this examinee had nothing to do with the incident under investigation. The reason that the specific responses appeared to the critical question was that she could guess the approximate, if not exact, amount in the envelope because she had started her job at the same time as the victim and had been doing the same kind of work.

Example 2: Testing was performed on the male neighbor of the victim (a middle-aged woman) who was under the suspicion that after killing the woman he attempted to disguise it as a suicide by hanging. Critical questions included the sash around the victim's neck, the place where the victim was hanging, and the stepping stool at her foot, placed to make it look as if she had committed suicide.

The examinee responded specifically to each of the critical questions. The following are reasons why this examinee, who was ultimately cleared of suspicion, responded specifically to the critical questions.

The examinee, who had become intimate with the victim while the husband was working away from home at temporary jobs or was hospitalized, had intercourse with the victim at her house several scores of times so that he was familiar with the household and knew what were asked in critical questions highly accurately, if not exactly.

(2) Cases in which contents of critical questions coincided accidentally with details of other crimes committed by the examinee.

Example 1: Questionnaire used for the examinee in a theft case contained items about methods of entry and searching, and the place where the stolen item (a woman's wrist watch) was found. Specific responses appeared only to the critical question on the stolen good. Responses to critical questions in other lists were not considered to be specific.

The reason why specific responses were elicited by the critical question about the stolen item was that, while the examinee was innocent concerning this case, he/she had recently stolen a woman's wrist watch and was hiding this fact.

Example 2: Question lists in a theft case contained items about the place of entry, security conditions at the place of entry, the place where the stolen cash was found (chest of drawers), and the way the cash was stashed. Specific responses were observed to the critical question about the place where the stolen cash was found, i.e., "chest of drawers." No specific responses appeared to other questions.

This examinee had not been connected with the case under investigation. The reason why specific responses appeared regarding the location of the cash was as follows: The examinee confessed that about a year before he had snuck into another place and had stolen

cash from a "chest of drawers." When checked against the confession, it came to light that there was a case similar to the one under investigation, although a report had not been filed.

9.3 Examples of POT question development

Example 1: The criminal of this case opened a transom window (unlocked) between 3:30 and 7:30 a.m. on April 5th and gained entry by standing on a trash container. The criminal stole a wrist watch (Casio, digital) lying on the TV in the living room and 235,000 yen placed in an empty cake box on the sideboard. The cash, together with a credit card and a seal (round and black), were placed in a paper bag with "Fuji Bank" printed on it. The cash consisted of twenty-three 10,000 yen bills and one 5,000 yen bill. The criminal escaped by unlocking the front entrance.

a. I am going to ask you if you know where the thief gained entry into the ** household in the morning of April 5th.

1. Do you know that the thief entered through the high window in the lavatory?
2. the bathroom window?
3. the transom in the kitchen? (critical question)
4. the low window [hip-high] in the children's room?

5. the window by the entrance hall?

Note: As the place of entrance holds importance to the criminal, it can be utilized as an appropriate critical question. Another list can be prepared by removing "window" from this list; e.g. 1. lavatory, 2. bathroom, 3. kitchen (critical question), 4. veranda, and 5. entrance hall.

b. I am going to ask you if you know how much cash was stolen from the ** household in the morning of April 5.

1. Do you know that the amount stolen was 68,000 (about 60,000) yen?
2. 152,000 ((about 150,000) yen?
3. 235,000 (about 230,000) yen?
(critical question)
4. 379,000 (370,000) yen?
5. 447,000 (about 440,000) yen?

Note: It is important to take into consideration the time elapsed from the time of the crime to the testing, the examinee's personality, and previous history (modus operandi). Often it is better to ask an approximate sum as indicated in (), since a criminal may not have counted the exact amount, or may have hidden the money without the time to count, or may not have realized the sum in minute detail.

c. I am going to ask you what else was stolen, other than cash,

from the ** household

1. Do you know that a necklace was stolen in addition to cash?

2. a brooch?

3. a ring?

4. a wrist watch? (critical question)

5. a camera?

d. I am going to ask you if you know what the thief used as a stepping stool to enter the ** household on the morning of April 5th.

1. Do you know that the thief stepped on the heater/air-conditioner?

2. a bicycle?

3. a garbage container? (critical question)

4. the "Bonsai" shelf?

5. the propane gas tank?

e. I am going to ask you if you know where the stolen cash was located in the house.

1. Do you know that the cash was on the cupboard for tea set?

2. on the record player?

3. in the desk drawer?

4. on the sideboard? (critical question)

5. in the cupboard?

f. I am going to ask you if you know in what container the stolen cash was found.

1. Do you know that the cash was in a handbag?
2. a large brown envelope?
3. a shopping bag?
4. a cake box? (critical question)
5. a suitcase?

g. I am going to ask you if you know where the stolen items other than the cash were found.

1. Do you know that the item was on the sofa?
2. a mirror stand?
3. TV? (critical question)
4. a bookcase?
5. a table?

Note: As to questions concerning the "escape route," burglars usually prepare one, a place such as the entrance hall or the kitchen from which it will be convenient to escape immediately after having gained entry. Therefore, it is unnatural to choose as a noncritical question such a place as bedroom where the family would be asleep.

Note: The question about "the items placed in the paper bag with

the cash" is not appropriate, because the criminals' goal is the cash and they do not often pay attention to other items such as a seal or credit cards.

Example 2: The criminal escaped after stealing a car, a Skyline hardtop GT.W which was parked on the street at 2-67 Sanwa-cho in the city, between 4 p.m. and 8:30 p.m. on June 8. It was a brown car. A set of baseball uniform and a bat in a bat case were left on the rear seat.

- a. I am going to ask you if you know the place the car was stolen from in the city on the afternoon of June 8.
 1. Do you know that the car was stolen from under the eaves in Goban-cho?
 2. a parking lot in Taisho-cho?
 3. the street in Sanwa-cho? (critical question)
 4. an empty lot in Myojin-cho?
 5. a garage in Matsunami-cho?
- b. I am going to ask you if you know what model car was stolen on the afternoon of June 8 in the city.
 1. Do you know if a light vehicle was stolen?
 2. a truck?
 3. a passenger car? (critical question)
 4. a pickup truck?

5. a light van?
6. a sport car?

Note: If the car stolen was a passenger vehicle, this list is questionable. Because, first, there are an overwhelming number of passenger cars around and secondly, if one thinks of "stealing to ride around in," the first image that comes to mind will be that of a passenger car.

c. I am going to ask you if you know what was on the back seat of the stolen car?

1. Do you know if an attaché case was on the seat?
2. a suit jacket?
3. a portable cooler?
4. baseball equipment? (critical question)
5. an audiotape carrying case?

d. I am going to ask you if you know the model and name of the car stolen.

1. Do you know that it is a Toyota Corolla?
2. a Mazuda Bongo van?
3. a Nissan Skyline? (critical question)
4. a Suzuki Cartus?
5. a Honda Civic?

Note: It is necessary to confirm the examinee's knowledge in asking questions on automobile names or models. In some cases, ask questions after giving explanations using photographs or other means.

Example 3: The criminal entered a gas station by breaking the south window and undoing the lock. The criminal stole 25,000 yen in cash (20 one thousand yen bills and 50 one hundred yen coins) in a plastic basket on the refrigerator on the north side of the office. After taking sausages and a bottle of beer from the refrigerator and consuming them, he escaped, unlocking the back door from inside.

- a. I am going to ask you if you know how the criminal entered the gas station.
 - 1. Do you know that the criminal entered by tinkering with the window frame and removing the window?
 - 2. tinkering with the door knob?
 - 3. breaking the window glass and unlocking it?
 - 4. unlocking the crescent lock attached to the high window?
- b. I am going to ask you if you know how much cash was stolen from the gas station.
 - 1. Do you know that 10,000 yen was stolen?
 - 2. 25,000 yen? (critical question)

3. 37,000 yen?
4. 42,000 yen?
5. 58,000 yen?

c. I am going to ask you if you know where the cash stolen from the gas station was.

1. Do you know that the money was stolen from the desk drawer?
2. the wooden box on the show case?
3. the basket on the refrigerator?
(critical question)
4. the envelope in the cabinet?
5. the cash register?

d. The criminal ate and drank in the gas station. I am going to ask you if you know what he ate and drank.

1. juice and ice cream from the icebox?
2. bread and cola in the rest room?
3. beer and sausages in the refrigerator? (critical question)
4. cake and banana in the cupboard in the kitchen?
5. Japanese cake on the coffee table?

Example 4: The victim (a 30 year-old housewife) was waiting for a bus

at approximately 8 p.m. on June 4 near the bus stop in front of the Daiwa Automobile Center on national highway 23. The criminal addressed the victim, asking "How do I go to the National Railroad station?" and while she was answering, suddenly pushed her, snatched her white leather handbag (that contained 32,000 yen in a red leather purse, a savings passbook issued by the Tokai Bank, keys, etc.) and ran away. The victim was wearing a blue dress. In addition to the handbag she had a green umbrella in her hand.

a. I am going to ask you if you know what type of woman was the one whose purse was snatched at the bus station along the national highway 23.

1. Do you know that it was a girl in her teens wearing a sailor dress?
2. a woman in her twenties wearing a pair of jeans and sweater?
3. a woman in her thirties wearing a dress? (critical question)
4. a woman in her forties wearing a kimono?
5. a woman in her fifties wearing a suit?

b. I am going to ask you if you know what was snatched away from her.

1. Do you know that it was a shoulder bag?

2. a purse?
 3. a handbag? (critical question)
 4. a suit case?
 5. a second bag [transliteration]?
- c. I am going to ask you if you know how much money was stolen.
1. Do you know that there was 15,000 yen?
 2. 23,000 yen? (critical question)
 3. 34,000 yen?
 4. 48,000 yen?
 5. 56,000 yen?
- d. I am going to ask you if you know how what else other than money was in there.
1. a gift certificate and cosmetics?
 2. credit cards and a memo notebook?
 3. a bank savings passbook and keys?
(critical question)
 4. stocks and a seal?
 5. a fixed time deposit book and a ball point pen?
- e. I am going to ask you if you know what the criminal said when he first spoke to the victim.
1. Do you know that he said "Do you know [where] the Plaza Building [is]?"

2. "Is there a drug store around here?"
3. "Does the bus to Mabashi come this way?"
4. "Which way to a National Railroad station?" (critical question)
5. "Where is the Kyosai Hospital?"

Example 5: On July 15, a criminal threatened the victim, (a woman, age 23) sleeping late at night in apartment Number 3 on the second floor of Sakae Apartment House, with a fruit knife and raped her after gagging her, binding her hands, and ripping off her panties with the knife. Before escaping, he took 23,00 yen in cash from victim's elegant case [transliteration; vanity case?].

a. I am going to ask you if you know with what the criminal, who entered the apartment late at night on July 15th and raped the woman, threatened her.

1. Do you know that he threatened her with a fish slicing knife?
2. a cutter knife?
3. a fruit knife? (critical question)
4. a pencil sharpening knife?
5. a mountaineering knife?

b. I am going to ask you if you know what the criminal did to the victim.

1. Do you know that the criminal took the quilt cover and placed it over victim's face?
2. covered the victim's face with a pillowcase?
3. covered the victim's eyes and pasted her mouth shut with sticky tape?
4. gagged her mouth and bound her hands?
(critical question)
5. covered her with a sheet and tied the upper part of her body in a sheet?

c. The criminal stole money after raping the woman. I am going to ask you if you know where the money was.

1. in a drawer of the dresser?
2. in a piggy bank on the TV?
3. in an elegant case [vanity case?]?
(critical question)
4. in a drawer of the cupboard for the tea set?
5. in a handbag?

d. I am going to ask you if you know how much money the criminal stole.

1. Do you know that he took 8,000 yen?
2. 17,000 yen?
3. 23,000 yen? (critical question)

- 4. 36,000 yen?
- 5. 45,000 yen?

e. I am going to ask you if you know what room on what floor the woman victim lived.

- 1. Do you know that she lived in number 4 on the first floor?
- 2. number 3 on the second floor?
(critical question)
- 3. number 5 on the third floor?
- 4. number 1 on the fourth floor?
- 5. number 2 on the fifth floor?

Example 6: At approximately 10 a.m. on August 3 the criminal picked up the key lying on the floor near the door of the victim's room in the apartment building. He used the key and entered the apartment and stole a red music box, made of wood that doubled as a piggy bank and contained approximately 3,000 yen in cash, a postal savings passbook that bore the victim's name (Kyoko Yamada) and a seal from a dresser drawer. Around 11 a.m. on the same day he went to the Sakura-machi postal office to fraudulently draw 38,000 yen from the passbook account.

a. I am going to ask you if you know how the criminal snuck into the apartment.

- 1. Do you know that the criminal pried opened the entrance

using a screwdriver?

2. entered through the unlocked window in the bathroom?
3. opened the door using the key he picked up? (critical question)
4. broke the glass of the high window in the lavatory?
5. opened the screen door in the kitchen?

b. I am going to ask you if you know where the cash the criminal took was.

1. Do you know that the money was in the coin purse to which a bell was attached.?
2. in an envelope on which a company name was printed?
3. in a piggy bank/music box? (critical question)
4. in a paper box with an alarm clock?
5. in a billfold on which a reproduction of a woodcut print was printed?

c. In addition to money, a savings passbook and seal were stolen. I am going to ask you if you know where they were hidden.

1. Do you know that they were in between bed quilts in a closet?

2. in a paper bag in the fancy case?

3. under the doll case?

4. in a dresser drawer? (critical question)

5. in between clothing in the dresser?

d. I am going to ask you if you know from which post office money was withdrawn using the stolen savings passbook.

1. Do you know that the money was withdrawn at the Kaga-cho Post Office?

2. the Tabata Post Office?

3. the Sakura-machi Post Office?
(critical question)

4. the Kikuta Post Office?

5. the Nakano Honcho Post Office?

e. I am going to ask you if you know how much money was withdrawn with the stolen savings passbook.

1. Do you know that 25,000 yen was withdrawn?

2. 38,000 yen? (critical question)

3. 46,000 yen?

4. 54,000 yen?

5. 67,000 yen?

Example 7: The victim was a 43 year old woman who operated a snack bar. The criminal spent the night at the victim's place. After having intercourse, the criminal fought with the victim and killed her by hitting her head with a bronze vase in the room. The victim was wearing panties and a flower-patterned negligee. The criminal ran away, forgetting his necktie in the room.

a. I am going to ask you if you know what the victim was wearing when she was killed.

1. Do you know that the victim was wearing a lounge-wear with splashed patterns?

2. a dress with lace?

3. a flower-patterned negligee?
(critical question)

4. a gown?

5. only brassiere and panties?

b. I am going to ask you if you know how the victim was killed.

1. Do you know that she was killed by strangulation?

2. poison mixed in a drink?

3. blows to her head?

4. stabs with a blade?

5. breaking the collar bone when flung
away?

c. I am going to ask you if you know what item the criminal

forgot in the victim's room.

1. Do you know that it was a neckerchief?
2. a pair of sunglasses?
3. a necktie? (critical question)
4. a lighter?
5. a wrist watch?

d. I am going to ask you if you know what the criminal used to hit the victim.

1. Do you know that the criminal used an ash tray?
2. a desk lamp?
3. a vase? (critical question)
4. a sculpted ornament?
5. a mantel clock?

Note: This list cannot be used when the questions about the method of killing have already been asked.

Example 8: At approximately 9 p.m., the criminal stopped a girl, a junior high school student (who was wearing a green sweater and a tan skirt carrying a white cloth bag) and was on her way home from attending an after-school cram course, and asked "Which way is the Shizanji Temple?" When the victim stopped, he suddenly grabbed her in his arms and took her into a parking lot right nearby to perform indecent acts on her, e.g. touching her bosom, etc. When the victim loudly cried for help, he ran away jumping over the parking lot fence.

- a. I am going to ask you if you know at what place the criminal stopped her with the intent of performing indecent acts.
1. Do you know that it was by the elementary school yard?
 2. near a park entrance?
 3. in front of a parking lot?
 4. in front of the place where building materials were stored?
 5. by an empty lot on a factory premise?
- b. I am going to ask you if you know what the victim had in her hand at that time.
1. Do you know that the victim had a school bag?
 2. a paper bag?
 3. a white cloth bag? (critical question)
 4. a polyethylene bag?
 5. a handbag?
- c. I am going to ask you if you know what the girl was wearing at that time.
1. Do you know that she was wearing a suit?
 2. a dress?
 3. a blouse and jeans?
 4. a sweater and skirt? (critical question)
 5. a vest and slacks?

10. Control Question Test

In CQT, questions are presented in a question list consisting of relevant, irrelevant, and control questions (which includes questions about a hypothetical crime) arranged in a certain way. Examinees' guilty consciences are detected through physiological responses expressed as changes in their emotional reactivity. Direct questioning as to whether or not examinees feel guilty about the crime becomes possible with this method. With this method it is also possible to prepare contents of relevant questions in proportion to the degree of examinees' involvement with the crime; further, the relative effectiveness between characteristics of control questions (including questions about hypothetical crimes) and relevant questions can be determined.

10.1 Construction of Questions

10.1.1 Construction of Questions Illustrated by Examples

(1) Example

"Between approximately 11 p.m. on March 3 and 6 a.m. on the 4th, someone snuck into Iseya Pawnshop, located in 3-chome, Honcho, and fled after stealing 100,000 yen in cash and jewelry." These facts were widely reported in newspapers and TV reports.

The examinee, 21 year old Taro Yamakawa, an employee of a "pachinko" parlor [electronic pinball game shop] and a current resident of the Chuo Apartment in 1-chome, Chuo-cho, of the same city, was arrested when he appeared at a jeweler's shop to sell the stolen jewelry. His permanent domicile is in Osaka.

(2) The CQT question list below is essentially made according to the standard order of arrangement presently in use.

- 1 Are you Mr Yamakawa?
- 2 Were you born in the Showa era?
- @ 3 Do you know the criminal who snuck into the pawnshop at 3-chome, Honcho on the night of 3 March?
- 4 Do you live in Chuo-cho?
- @ 5 Did you sneak into the Iseya Pawnshop and steal 100,000 yen in cash and other things?
- o 6 Have you ever stolen gifts [prizes for winning the game; cash prize are not allowed] at the pachinko parlor where you work?
- 7 Do you live in an apartment in Chuo-cho?
- # 8 On the night of February 28 did you sneak into the Kadoya Drugstore, located in 1-chome Honcho?
- @ 9 Did you sneak into the Iseya Pawnshop?
- 10 Is your permanent domicile in Osaka?

Marks in front of previous questions: @, relevant; o, control; #, hypothetical; irrelevant question are unmarked

(3) The relevant question, the third on the list, asks if the examinee knows the person who has committed the crime. Relevant questions, five and nine, ask if the examinee has participated in the crime.

The control question, six, is concerned with a fact confirmed by the investigator, yet firmly denied by the examinee.

The hypothetical question, eight, asks about a crime hypothetically set up by the examiner.

10.1.2 Addition of relevant questions

More relevant questions can be added to a standard CQT question list. In the example in 3.1.1 [sic; 10.1.1?], the following two questions are added as 10th and 11th questions, leaving the other nine questions as they are.

10 Did you go to the Iseya Pawnshop the night that it was
burglarized?

(The examinee answered in the negative).

11 Have you lied to the questions given so far?

10.2 Irrelevant questions

10.2.1 Significance

(1) When a series of stimuli are presented, records of measured physiological responses show prominent responses to the first stimulus, regardless of its content. In order to elicit this response, the so-called orienting response, irrelevant questions are placed at the beginning of a question list.

(2) If relevant, control, and hypothetical questions are presented sequentially, responses to them may overlap. Irrelevant questions are inserted in between to buffer this effect.

10.2.3 Contents

In the example in 10.1.1 numbers 1, 2, 4, 7, and 10 are irrelevant questions. Personal matters concerning examinees, e.g. name, age, or address, are generally used as irrelevant questions.

Necessary items are copied beforehand from examinees' depositions, etc. later to be confirmed with examinees themselves at the time of interview.

10.2.4 Basic conditions

(1) Irrelevant questions contain already known facts. Questions that examiners merely assume to be factual should not be used. Even with such a matter as age or name, examinees do not necessarily answer truthfully. Therefore, if not confirmed, question format such as

"Were you born in the Showa era?" or "Are you called Mr. Taro Yamakawa?" should be used, instead of asking "Are you 21 years old?" or "Are you Mr. Taro Yamakawa?"

(2) When using unconfirmed materials, it should be kept in mind that examinees occasionally attempt to test the reliability of the polygraph test by intentionally giving false answers. As a result, relatively large responses may appear to questions the examiner has set up as irrelevant questions. If this causes confusion to the entire record there is a danger that the comparison of responses to relevant, control, and hypothetical questions will be greatly hindered at the post-test stage of record examination.

(3) Irrelevant questions should literally be concerned with matters totally unrelated to the crime. That is, these questions should not arouse emotional reactions in examinees. Even so personal a topic as the name of the examinee's wife or a child if used as an irrelevant question may act as a stimulus that evokes strong emotion. Matters that may divert the examinee's attention from relevant or control questions also are inadequate. If a question concerning a personal interest is used as an irrelevant question, e.g. "Do you smoke?" or "Do you play golf?," examinees can disturb records by concentrating their attention intentionally on such a question.

3.2.4 [sic; 10.2.5?] Reading to examinees

(1) Examiners read contents of irrelevant questions to examinees in the same way as other questions are read and make sure that these are understood perfectly.

(2) Make clear that what examiners will present to examinees as irrelevant questions are limited only to those read to them; no other questions will be presented.

10.3 Relevant questions

10.3.1 Significance

Relevant questions are the important questions asked for the purpose of evoking responses that provide clues in evaluation of whether examinees possess a guilty conscience regarding the crime that is the target of the test.

10.3.2 Contents

(1) In a standard CQT list, relevant questions are placed in the third, fifth, and ninth positions. Question contents are expressed according to somewhat differing nuances depending on their position.

(2) The relevant question is in the third position and is expressed somewhat indirectly. Namely, the question takes a form such as "Do you know the criminal?" The following are typical examples of

questions asked in different categories of crimes.

- 1 Theft: "Do you know the criminal who stole a TV (last Saturday night) from the municipal office?"
- 2 Burglary: "Do you know the criminal who robbed the gasoline station (the night of May 11) in Fujimi-cho?"
- 3 Murder or infliction of injury: "Do you know who stabbed a taxicab driver (the night of March 4) in front of the station?"
- 4 Rape: "Do you know who raped a young woman (the night of August 5) in a vacant lot behind the station?"
- 5 Arson: "Do you know the criminal who set fire (last night) to the back entrance of Hinode Inn?"

(3) The relevant question in the fifth position is directly expressed. That is, it is expressed as "Did you do . . .?" or "Was it you who did . . .?" In contrast to the third question that asks about perception or knowledge about the criminal, the fifth question asks directly whether the examinee has participated in the crime. Typical questions are as follows:

- 1 Theft: "Did you steal 680,000 yen in cash from the safe kept in the accounting office?"

- 2 Burglary: "Did you burglarize Asahi Grocery?"
- 3 Murder or infliction of injury: "Was it you who stabbed a young man in the tavern behind the station?"
- 4 Rape: "Did you force a young woman whom you encountered on the street in Fujimi-cho to have intercourse?"
- 5 Arson: "Was it you who set fire to the fuel storage of Asahi Bath [a public bath]?"

(4) As with the fifth question, the ninth question uses a direct form of expression. Compared to the fifth question, however, the intent here is to question from a somewhat different angle. Typical questions are as follows:

- 1 Theft: "Did you sneak into a room on the first floor in the Green Mansion?" or "Do you know where the jewelry stolen from the Green Mansion is now?"
- 2 Burglary: "Did you threaten a female salesperson by pointing a knife at her in Chuo Drugstore?" or "Were you there when the Chuo Drugstore was burglarized?"
- 3 Murder or infliction of injury: "Did you quarrel with a young man wearing a leather jacket in the bar behind the station?" or "Do

you know where the knife with which a young man was stabbed in the bar behind the station is at present?"

4 Rape: "Did you hit a young woman whom you encountered on the street in Saiwai-cho?" or "Did you forcibly drag a woman in a blue coat into a vacant lot?"

5 Arson: "At the time of a fire in the Espoir Tearoom, did you see the garbage dump flare up?" or "Did you set fire to old newspapers behind Espoir?"

With the ninth question, a somewhat different way of expression should be devised while maintaining the connection to the contents of the third and the fifth questions. However, the expression should be closer to the contents of the fifth question, rather than taking the form of "Do you know . . .?"

10.3.3 Basic conditions

(1) The necessary condition for a relevant question is that it is easily understood. Questions are presented by reading them. Therefore, a relevant question must be understood completely upon hearing it once. If examinees misunderstand a question when it is read to them, sometimes, depending on the question contents, the targeted effect of the relevant question cannot be expected.

(2) For the meaning of questions to be perfectly understandable, appropriate words must be chosen. Words used in daily life are easy to understand, since people hear them often. Therefore, during the interview that precedes questioning, sufficient attention must be paid to what expressions are used by the examinee regarding the content of the crime. In framing questions words used by the examinee or expressions close to them should be chosen. In some cases, it may be necessary to explain the meaning of some words to examinees before questions are presented.

(3) Long questions should be avoided. The time required for presentation of a long question tends to blur its meaning and, at the same time, weakens the impression it evokes. Even with examinees who are stating truth about the crime targeted in the test, a long question may elicit confused responses. Prominent physiological responses may appear as the result of emotional arousal, because examinees may struggle when they have not understood a part of the question, or they may be answering hesitatingly thinking that their answers are not accurate.

When a long question must be asked so that the examinee will understand clearly the nature of the crime under investigation, the question must be read and explained to the examinee before its presentation. Otherwise, tell examinees beforehand that once recording of responses has started, questions will be presented in a shortened form; in practice, present only the essential part, omitting the

preliminary part of the question.

(4) Contents of relevant questions must be limited to one single case. Simultaneous testing of mutually unrelated crimes is not effective. Examinees who have committed crimes repeatedly and are hiding this for personal reasons (beyond what the examiner can imagine) occasionally concentrate their attention on one particular crime. In such a case, it is possible that prominent responses may occur only to questions relating to that particular crime, while no specific responses appear to other crimes even though the examinee is hiding facts.

(5) Absolutely avoid asking questions with double meanings. Questions such as "Did you hit a young man on the street or did you merely threaten him?" and "Did you snatch a handbag after you hit the young woman?" are examples of this kind of question. In answering a double question that contains two types of deeds or events, the answer, "No," may be truthful to one part, but may be a lie regarding the other part.

(6) Materials that can be used as critical questions in POT should not be included in relevant questions. However, when much good material for critical questions is available, it may sometimes be necessary to use such a material as a relevant question in order to reinforce relevant questions. For example, the question "Did you sneak into Fuji Bookstore and steal 380,000 yen in cash?" is

doubtlessly much clearer and gives a stronger impression than the question "Did you sneak into Fuji Bookstore?"

3.3.4 [sic; 10.3.4] Reading to Examinees

The examiner reads relevant questions to the examinee and makes certain that he/she has understood them completely before answering in the negative.

10.4 Control Questions

10.4.1 Significance

Relevant questions are presented with the purpose of obtaining the criteria to determine if the examinee has guilty feelings about the crime under investigation or not. Control questions are used to evaluate whether responses to relevant questions are evoked not out of examinees' guilty feelings, but rather, they are triggered by the particular words being used in the relevant questions, when examinees are oversensitive to external stimuli because they are under investigation. That is, the evaluation is made by comparing responses to relevant and control questions.

10.4.2 Contents

There are no control questions that can commonly be used in all types

of polygraph test. Control questions need to be constructed for each individual case.

10.4.3 Basic Conditions

(1) Control questions are of approximately the same nature as those addressing the crime being tested and concern one or another form of antisocial behavior. Control questions have contents to which examinees are certain to answer falsely.

(2) The most pertinent control questions are prepared using the type of materials next described. Namely, the examinee has committed another crime unrelated to the present one. This crime has been confirmed, but the examinee is not aware of the detection. When this condition is satisfied, questions are prepared using these materials.

10.4.4 Question Construction

Control questions are set up in such a way as to always have examinees answer in the negative. Question content must have a high probability of making examinees give false answers, or must be such that it may be assumed that the examinees themselves are not convinced of the truth of their negative responses to them.

10.4.5 Evaluation

(1) The examiner's intent in creating control questions is not only to ascertain facts but also to have examinees' interest concentrate on the control questions.

When giving false answers regarding the crime being investigated, the examinee has a much higher interest in a relevant question the contents of which relate to the crime than in a control question, even though the examiner has emphasized the latter's importance. Therefore, the examinee's false answer to a control question evokes relatively less prominent responses than his/her responses to a relevant question.

(2) With examinees who are answering truthfully about the crime being investigated, their interest focuses on the control question when the content of the control question is emphasized. As a consequence, when examinees who are truthful give false answers or are concerned as to whether their answer really is truthful or not, their responses appear specific in comparison to their responses to a relevant question. Thus, when evaluating responses to a relevant question, responses to a control question indeed serve as control.

(3) Figure 1 is a test record of a case judged to be positive. This evaluation was later confirmed. Compared to responses to the control question (question number 6), responses to the relevant question (question number 5) are obviously specific.

(4) Figure 2 is a test record of a case judged to be negative; this evaluation was later confirmed. Compared to responses to the relevant question (question number 5), responses to the control question (question number 6) are about the same and cannot be called specific.

(5) Figure 3 is a test record of a case judged to be negative; this evaluation was later confirmed. While responses to the relevant question (question number 5) are prominent, responses to the control question (question number 6) are as prominent as the former.

10.4.6 Reading to Examinees

When control questions are set up, the examiner reads them to the examinee to verify that the examinee has completely understood the question content; examinees are to answer in negative with a full understanding of the content. At that point examinees occasionally may say something such as, "Upon reflection, I have remembered something else" and change his/her answer to the control question to the affirmative. In such a case, interview the examinee again to change the content of the question so that the his/her answer to it will be changed to the negative.

10.5 Questions About a Hypothetical Crime

10.5.1 Significance

Even examinees who have nothing directly to do with the crime being tested may become nervous, because the situation of being tested itself evokes anxiety. Consequently prominent responses may appear at the presentation of a relevant question, that relates to crime contents being tested themselves. Responses to questions about a hypothetical crime are used to differentiate this type of response from those elicited out of an examinee's sense of guilt.

10.5.2 Contents

A hypothetical crime is set up; its contents become the source of questions.

10.5.3 The Limit of Application

The examiner must make the examinee's interest focus on the questions about the hypothetical crime by emphasizing that it is an actual crime, circumstances about which cast doubt on the examinee. Therefore, the hypothetical crime must not be of the nature that convinces the examinee that he/she could not have committed such a crime. The relevancy to the crime being tested is especially important and in some cases, a hypothetical crime cannot be set up. That is, if the crime under investigation is of a type unlikely to be repeated, hypothetical questions cannot be applied. An inappropriate example would be to ask hypothetical questions about "arson out of a grudge" to an examinee who is under the suspicion of having set fire

to the house owned by himself/herself aiming at insurance compensation. Also questions about a hypothetical case, "the murder of another woman," are inappropriate to an examinee under suspicion of having murdered his lover. Therefore application of CQT in these cases is quite difficult.

10.5.4 Introduction

(1) Effective application of hypothetical crime questions becomes possible solely based on thorough studies of question contents and the pretest introduction. When the examiner explains the content of control question lists to the examinee, sufficient time should be spent also on the discussion of contents of hypothetical crime questions. The examiner explains that, considering the pattern of crime, chronological and geographical conditions, there is a high probability that the same criminal is involved.

(2) Newly introducing Contents of a hypothetical crime acts increases tension in examinees who are speaking truthfully regarding the crime being tested. The majority of such examinees display an agitated manner of speech or movements. Examinees' attention will focus on the contents of hypothetical crime questions.

(3) Examinees who are hiding their criminal act calmly accept the contents of hypothetical crime questions. Their interest focuses only on the crime they have actually committed; they are hardly interested

in the hypothetical crime. Rather, they accept positively hypothetical crime questions to which they can answer truthfully saying that "I had nothing to do with it."

10.5.5 Basic Conditions

(1) For the contents of hypothetical crime questions, choose a (fictitious) crime similar to that under investigation. The contents need to be quite realistic for the examinee. While fictitious, therefore, too obviously fantastic and artificial crimes must be avoided. For example, there is a likelihood that examinees do not perceive an atrocious hypothetical crime, such as a murder or a burglary/murder case, as real. If such a case had actually taken place, newspapers and television would have reported it so prominently that the public would naturally know about it. Examinees must wonder why they are nevertheless being asked about a murder they have never heard of. When using an atrocious crime as a hypothetical crime question, therefore, care must be taken to make it appear that the crime has occurred in a neighboring prefecture or that it happened several years ago so as to avoid skepticism on the part of the examinee.

(2) The hypothetical crime must appear of equal importance to the examinee as the crime targeted for investigation. If the crime under investigation is burglary/murder, the hypothetical crime should not be a simple murder case; it should also be constructed as a case of

burglary/murder. If the test concerns a petty swindle, the hypothetical crime also should be a case of petty swindling, not a marriage fraud: for automobile theft, set up a case in which a car is stolen, not sneaking into a house.

(3) The execution of the crime as expressed in hypothetical crime questions must be logically seen by the examinee as feasible. Setting up of a crime that is supposed to have taken place while the examinee was serving a prison term must absolutely be avoided.

(4) Contents of hypothetical crime questions need to be such that the examinee notices instantaneously that he/she has nothing to do with it. Questions that refer to another crime the examinee may have committed are not appropriate. That is to say, when the examinee is hiding his/her own crime and has committed another crime of the same mode of operation, the content of a hypothetical crime should not make the examinee think that it might have been his/her own crime.

10.5.6 Evaluation

(1) If procedures for setting up hypothetical crime questions as well as their execution have been followed accurately, the result obtained comparing responses to hypothetical crime questions and those to relevant questions can serve as the criterion to determine the presence or absence of examinees' guilty consciousness.

(2) When responses to hypothetical crime questions are specific or approximately at the same level as responses to relevant questions, the indication is that the examinee does not feel guilty regarding the crime being tested.

(3) When no responses appear to hypothetical crime questions, or are very small compared to responses to relevant questions, the indication is that the examinee feels guilty toward the crime being tested.

(4) Figure 4 is a test record of a case judged to be positive; this evaluation was later confirmed. Compared to responses to the hypothetical crime question (question number 8), responses to the relevant question (question number 9) are obviously specific.

(5) Figure 5 is a test record of a case judged to be negative; this evaluation was later confirmed. Compared to responses to the relevant question (question number 9) responses to the hypothetical crime question (question number 8) are obviously specific.

10.5.7 Reading to Examinees

Examinees should not find out the contents of a hypothetical crime question only after the question presentation session has begun; question contents should be communicated beforehand. Even an examinee who has been hiding his/her own crime is familiar with the contents of relevant crime questions because the question contents have been fully

explained. By contrast, if a hypothetical crime question is suddenly presented, relatively prominent physiological responses may appear, triggered by the novelty of such a question acting as a strong stimulus. Therefore, when questions are introduced at the time of the interview, hypothetical crime questions are to be read to examinees before the questioning in just the same way as other questions; ascertaining that examinees are answering in the negative with a full understanding of contents.

10.6 Points to pay Attention to in Question Presentation

10.6.1 Time Interval

(1) The time interval for the presentation of questions is determined by index specific latency (the time between the question presentation and the appearance of a response) and reaction time (the time between the response onset and the return to the preresponse level); indexes are physiological responses to be measured and recorded. With the three indexes employed in the present polygraphy tests, the standard time interval between questions range 15-20 seconds.

(2) One exception is: After the presentation of the first, second, and tenth nonrelevant questions, the time interval of 5-10 seconds is acceptable. The main purpose of setting up the first and second question is to accustom the examinee to the sequence of question-answer. Responses to these questions do not count in decision making.

(3) The phenomenon of response elicitation, observed generally to the first and last questions regardless of their contents, is due to the fact that the presentation of question itself acts as a stimulus. The tension, "the test has begun" to the first question, and the relief, "the test has come to end" to the last question, evoke emotive responses. Therefore, responses to questions in these positions need to be eliminated as objects for evaluation, or if used for decision making, the presence of this special phenomenon needs to be taken into consideration.

10.6.2 Influence of Cardio Cuff Pressure

One of the purposes of shortening the testing time is to minimize the time the cuff pressure used to pick up cardio responses for measurement is applied.

The cuff pressure at the level of 60-90 mmHg must be applied to obtain optimal cardio tracings. If the cuff pressure at this level is maintained 4-5 minutes, the arm or hand might feel numbness, because the blood flow is suppressed. No pain should be felt. However, some examinees may complain of pain from fear of this strange sensation.

(2) [sic; where is (1)?] Once examinees find themselves in such a state, their attention may come to focus so much on the cuff pressure as well as on the sensation that arises from it, that they may not pay attention to questions presented by the examiner. Therefore, one of

the conditions for effectively conducting tests is to minimize the length of time cuff pressure is applied to examinees.

10.6.3 Record Disturbance

(1) Time intervals between question presentation should not be shortened beyond the necessary limit just for the consideration of minimizing the length of time cuff pressure to be applied to examinees. Response records are disturbed especially when examinees have moved, coughed, or sighed. For that reason, a new question should not be presented until the record returns to the normal state.

(2) If record disturbance does not disappear easily, bring the record back to the normal state by temporarily presenting a nonrelevant question, ignoring the established order of presentation.

10.7 Examples of Responses

10.7.1 Negative Evaluation

(1) Prominent EDAs appear to relevant questions (numbers 3, 5, and 9), control question (number 6), and hypothetical question (number 8). Hardly any change appears in plethysmogram. A suppressed breathing wave response appears only to control question (number 6). This examinee was evaluated in the negative; this decision was later confirmed.

Figure 6

(2) Prominent EDAs appear to relevant questions (numbers 5 and 9), control question (number 6), hypothetical question (number 8), and various nonrelevant questions. While cardio responses appear to control question (number 6), hypothetical crime question (number 8), and relevant question (number 9), they are not considered to be specific. Suppressed breathing wave response appears to hypothetical crime question (number 8). This examinee was evaluated to be negative; this decision was later confirmed.

Figure 7

(3) Responses appear in breathing tracings and plethysmogram to relevant questions (numbers 3 and 5). However, the same level of responses appear also to control question (number 6) both in breathing tracings and plethysmogram. This examinees was evaluated to be negative; this decision was later confirmed.

Figure 8

10.7.2 Positive Evaluation

(1) Of the three indexes, prominent responses appear in breathing and EDA tracings. While baselines in breathing tracings are generally not stable, specific response (blocks) appear to relevant questions

(numbers 5 and 9). While suppressed responses appear to the control question (number 6) and hypothetical question (number 8), they cannot be called specific when compared to responses to relevant questions (numbers 5 and 9), to which prominent EDAs appear. This examinee was evaluated to be positive; this decision was later confirmed.

Figure 9

(2) Almost no respiratory responses appear to any of the questions. However, specific EDA [GSR] and plethysmographic tracings appear to relevant questions (numbers 5 and 9). Some plethysmograms appear to control question (number 6) and a hypothetical crime question (number 8), but they cannot be called prominent when compared to responses to relevant questions (especially number 5). This examinee was evaluated as positive; this decision was later confirmed.

Figure 10

(3) Prominent responses appear to all three indexes, breathing and EDA [GSR] tracings, and plethysmogram. Responses to relevant questions (especially to number 5) are prominent, typical of specific responses.

Figure 11

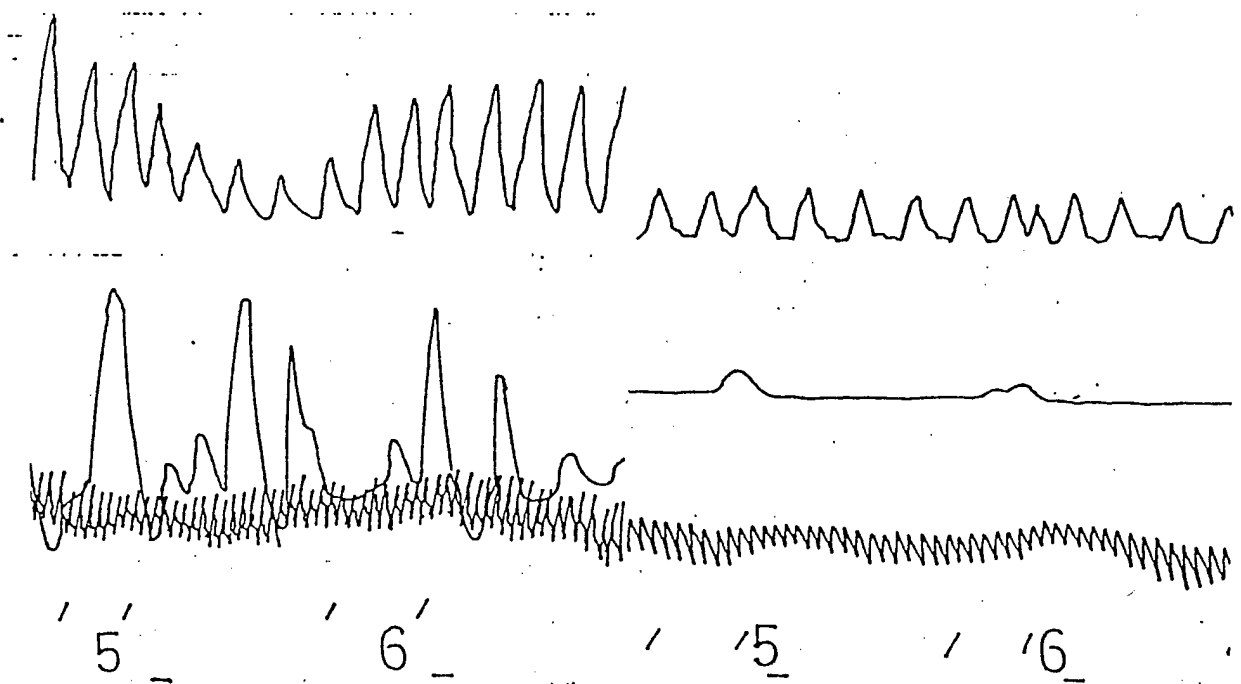


图 1

图 2

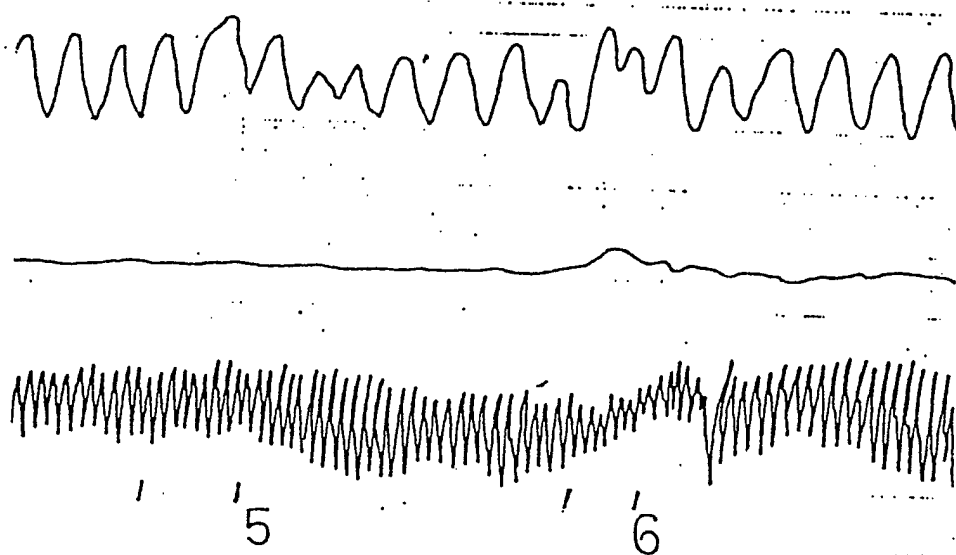
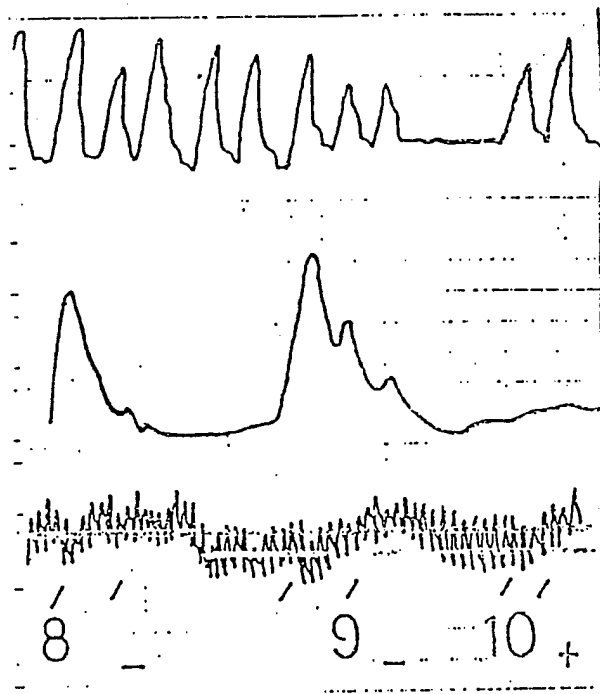
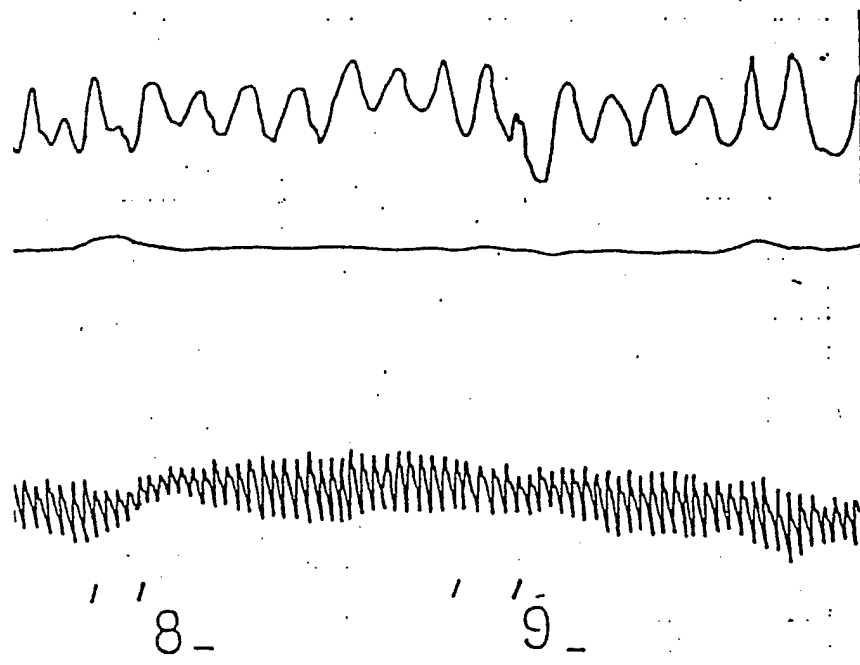


图 3



⊗ 4



⊗ 5

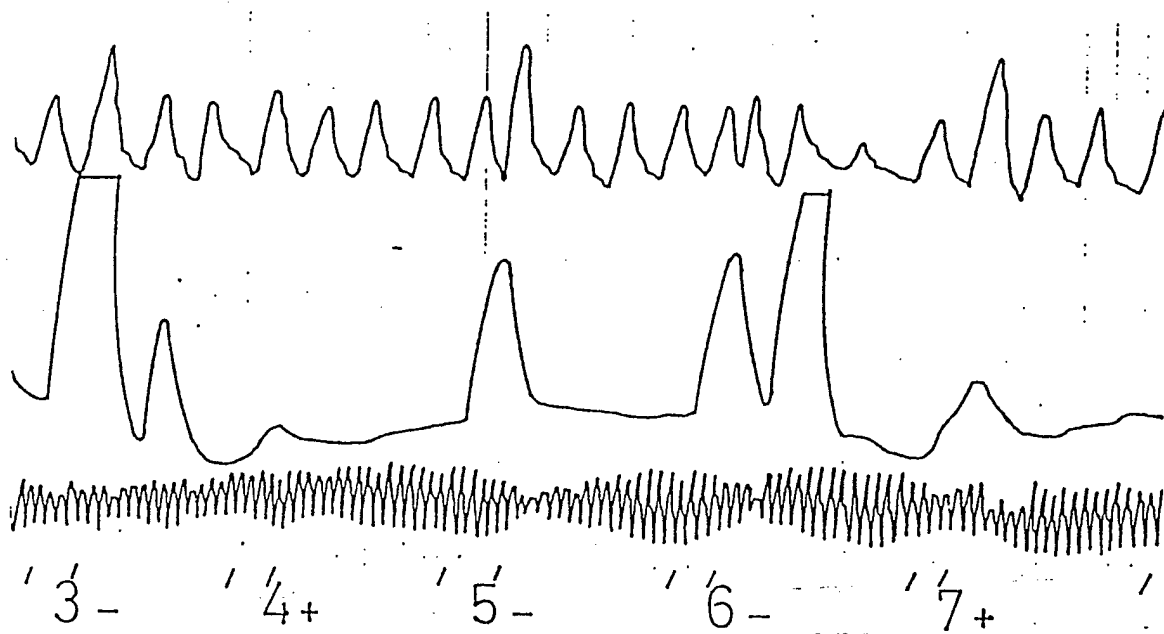


图 6

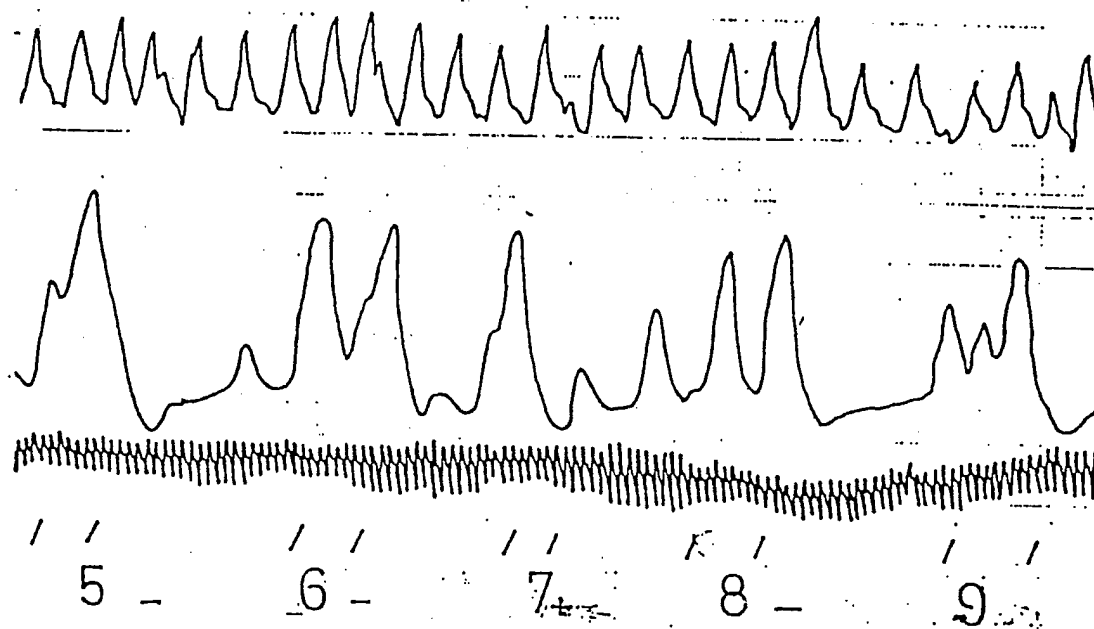
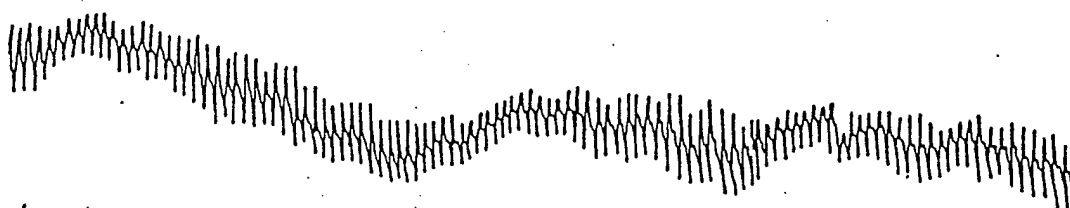
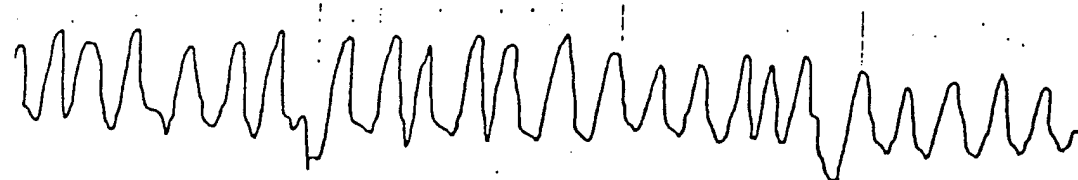
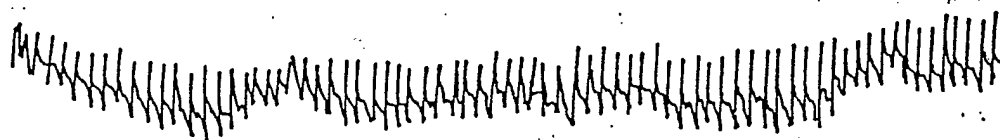
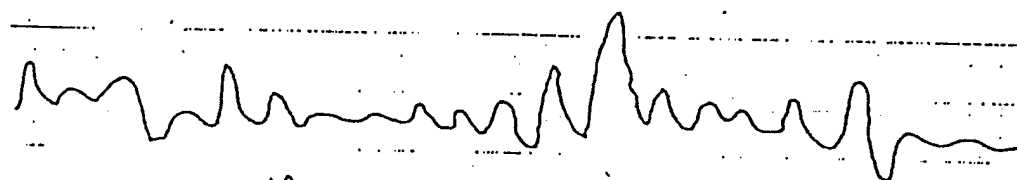


图 7



' 3 - ' 4 + ' 5 - ' 6 - ''

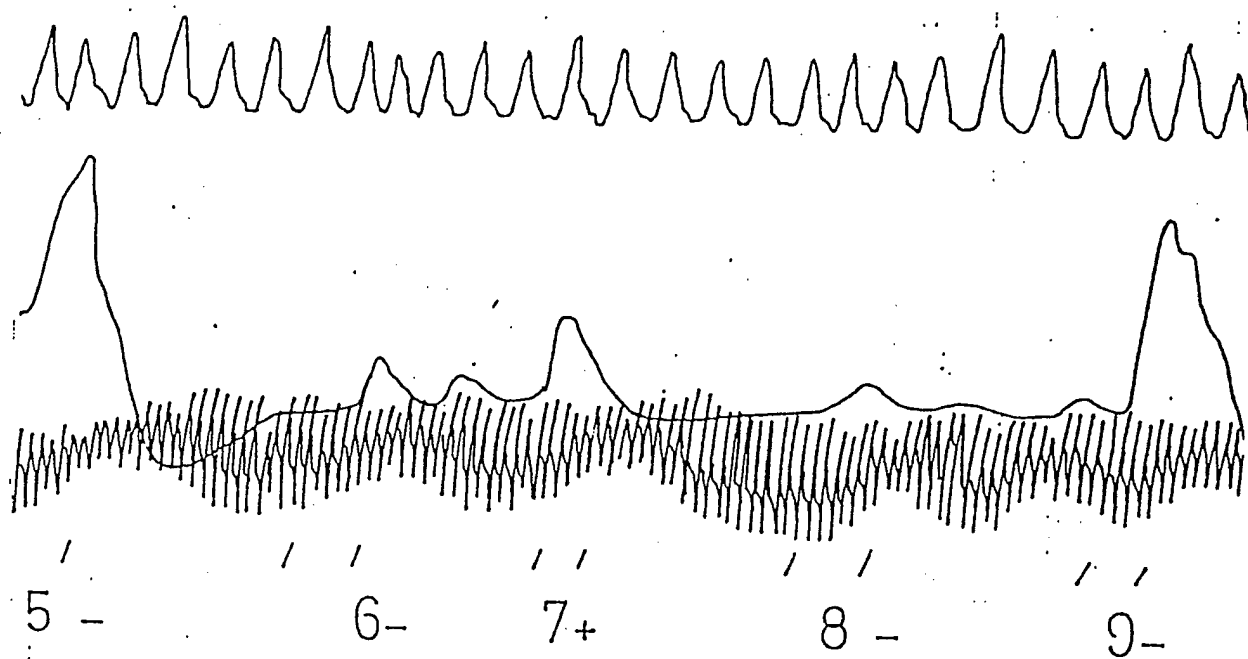
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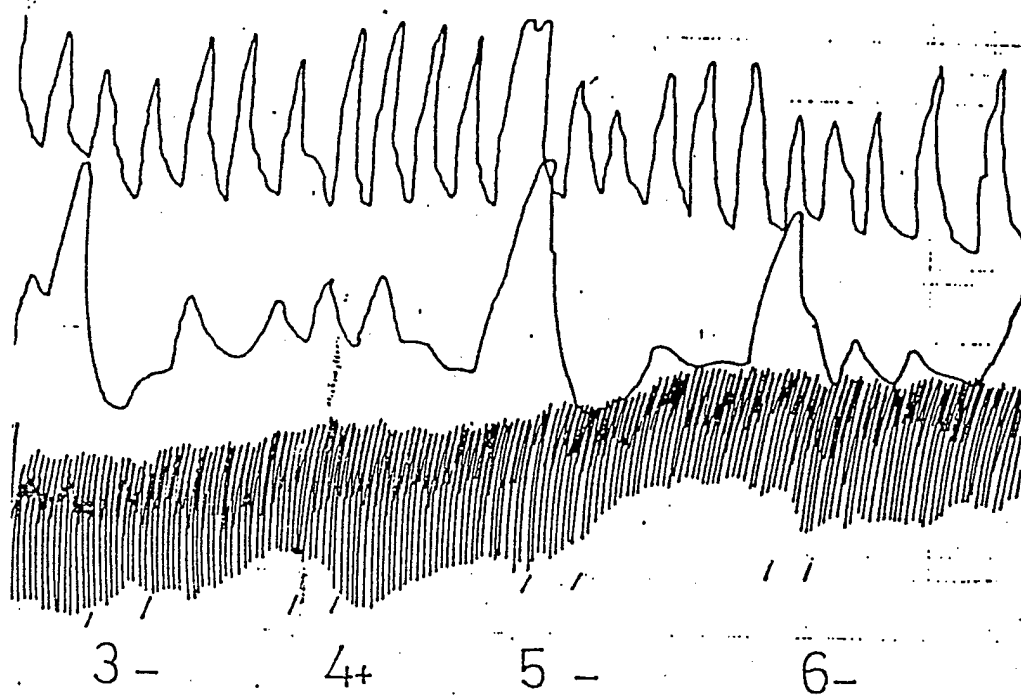
' 4 + ' 5 - ' 6 - ' 7 + ' 8 - ' 9 -

9

10 - 21



10



11

11. Control Question Test: Literature Survey

11.1

Podlesny, J.A. and D.C. Raskin. "Physiological Measures and the Detection of Deception." Psychological Bulletin, v. 84 (4), 1977, 782-799.

11.1.1 Introduction

(1) Definition of deception: Deception is defined as an act or behavior designed to conceal or distort the truth for the purpose of misleading others.

(2) Psychophysiological detection of deception (PDD): PDD is a method of determining whether an examinee is attempting deception by analysis of the physiological activity manifested in response to a series of questions or other stimuli presented.

(3) Goal of PDD: PDD aims to infer with a high degree of accuracy the extent of an examinee's deceptiveness.

(4) Principal advantages of experimental studies: 1) Results can be clearly identified; 2) various variables can be controlled; 3) state-of-the-art equipment can be employed.

(5) Problems in experimental studies: 1) The different natures of experimental situations and real life situations; 2) dissimilarity of the populations [from which members of experimental as against real life groups are drawn].

This study reviews the criteria that experimental studies must meet for PDD test measures to be applied to practical situations.

11.1.2 The Context of Deception

- (1) Card test paradigm
- (2) Personal involvement paradigm
- (3) Mock agent paradigm
- (4) Mock crime paradigm
- (5) Studies under high stress
- (6) Motivation
- (7) Threat of punishment

Development of a context for detection of deception as it appears in real life testing is difficult. It is important to establish a situation in which such variables as type of examinee, their ego involvement and motivation correspond to those appearing in the real life setting.

11.1.3 General Considerations

(1) There exists no specific pattern of physiological activity that is associated with deception as such.

(2) For accurate inference of deception through recorded physiological activity the following factors must be controlled:

- 1) Differences in the arousal inducing value of the stimuli
- 2) Attentional responses produced by varying stimulus characteristics
- 3) Habituation with repetitive presentation of stimuli
- 4) Individual differences in tonic and phasic activity
- 5) Inherent variability of physiological data

(3) Methods of control (CQT)

- 1) Place the relevant and control questions close to each other, keeping the number of questions the same.
- 2) Heighten the examinee's attention to questions (through interview).
- 3) Make conclusions by comparison of relevant and control questions.

11.1.4 Tests of Deception

(1) Card tests

(2) Peak of tension tests

A judgment of deception is arrived at when gradual changes in physiological activity show disruption in the vicinity of a relevant item.

(3) Relevant-irrelevant tests

In this type of test, question series consist of relevant as well as irrelevant questions. When responses to relevant questions are larger than those to irrelevant questions, a conclusion of deception is reached. When the reverse occurs, or no difference is found, a conclusion of truthfulness is determined. Problems associated with this testing method are as follows:

- 1) Relevant questions may be easily discernible as such to the criminal as well as to the innocent.
- 2) Relevant questions tend to evoke responses easily.
- 3) Examinees who have a low degree of responsiveness tend to be judged innocent.
- 4) Determinations of inconclusiveness are reached frequently.

(4) Control Question Tests (CQT)

CQT employs control questions that are presented close in time to the relevant questions. The control questions are formulated in a pretest interview so that the examinee is always answering falsely, or is very concerned about them. Examinees who are truthful in answering relevant questions tend to be more concerned about control questions

and show prominent responses to them. Those who are deceptive tend to respond more prominently to relevant questions.

Numerical Scoring of Responses

	Accuracy rate	Inaccuracy rate	Inconclusive rate
Barland & Raskin	81%	(19%)	
(1975)	53%	12%	35%
Raskin	96%	(4%)	
(1975)	88%	(4%)	8%

Inaccuracy Rate of CQT

	False positives	False negatives
Barland & Raskin (1975)	8%	4%
Raskin (1975)	4%	0
mock crime exp. (CQT)	2%	8%
" " " (GKT)	0	10%

(5) Guilty Knowledge Test (GKT)

The GKT bases decision making on the presence or absence of specific responses to items of information that only the real criminal recognizes.

11.1.5 Data Analysis

(1) Objective quantification method

(2) Mean rank method

11.1.6 Physiological Measures

11.2

Lykken, D. T. "The Detection of Deception." Psychological Bulletin, v. 86 (1), 1979, 47-53.

11.2.1 Introduction

Raskin has stated that polygraph testing has an accuracy of at

least 96 percent. Podlesny and Raskin further state that a very small number of studies have failed to develop "promising" indicators because of defective experimental design, which if remedied, might

enhance their validity even further. If Podlesny and Raskin's indications are correct, we are not only dealing with the most valid psychological test ever devised, but also with the most important social problem that has ever been addressed from psychological laboratories.

11.2.2 Theory of Lie Detector Tests

Podlesny and Raskin (1977): Lykken's hypothesis (1974), "Control questions are designed to make subjects answer truthfully: When responses to control and relevant questions do not differ, the result is negative" is not correct.

Lykken: The second hypothesis does not appear in my article (1974) [as quoted by Podlesny and Raskin]: It says, instead, that "If no difference exists, classify the result as inconclusive." The first hypothesis, if correctly cited, says that "the selection of control questions are done aiming to evoke responses that indicate guilty attitude and emotive responses; subjects are expected to respond truthfully to these questions".

Table 1. Raskin's Questionnaire

-
1. Were you born in Hong Kong? (Yes)

2. Do you intend to answer truthfully to questions concerning the stabbing of Ken Chiu? (Yes)
3. Do you understand that you will be asked only those matters we talked about earlier? (Yes)
- * 4. Before the age 18, did you injure a person? (No)
- o 5. On January 23, 1976, did you cut anyone on Dumphreys Street?
(No)
- * 6. Before 1974, did you attempt to inflict a serious injury on anyone? (No)
- o 7. On January 23, 1976, did you stab Ken Chiu? (No)
8. Is your surname Williams? (Yes)
- * 9. Before you were 19, did you lie in order to escape getting into trouble? (No)
- o 10. Did you actually see Ken Chiu being stabbed? (No)

Can a test that uses a list such as in Table 1 reasonably be expected to yield a result with an accuracy of over 90 percent? There is a high probability that the answers to questions numbers 4 and 9 will be lies. If control questions must be assumed to be "known lies," except in special cases such a test will be impossible [to design?].

The aim of control question:

- (1) Control questions elicit emotive responses from subjects (Lykken, 1974).
- (2) Subjects "are very concerned" about control questions (Podlesny & Raskin, 1977).

Basic assumptions of polygraph testing:

- (1) Control questions serve the function of control in a scientific sense.
- (2) When subjects are telling the truth, responses to control questions provide reasonable material to make conclusions regarding responses to relevant questions.

Lykken: Such hypotheses cannot be supported.

11.2.3 Accuracy of the Polygraph Test in Real Life Applications

In order to estimate the accuracy of the polygraph test in real life applications, (1) it is necessary to pay attention to appropriate studies of real-life applications, and (2) to exclude studies on overall review of the test.

11.2.4 Proof

Research works that evaluated the accuracy of polygraph tests in real-life conditions

(1) Horvath (1977)

Ten experienced polygraph examiners, different from the original testing examiners, evaluated the polygraph charts drawn from a pool of files maintained by a police headquarters. Twenty eight charts

belonged to those whose innocence was established, while another twenty eight were of those who were confirmed to be guilty.

Results: Rate of agreement among evaluators 89%
Accuracy of evaluation 64%
Guilty group 77% positive evaluation
Innocent group 39% negative evaluation

(2) Barland & Raskin

Ninety two criminal cases were evaluated by lawyers on the basis of evidences other than polygraph test results. Cases in which evaluations by a majority of lawyers agreed were compared to Raskin's evaluations based on polygraph tests.

Results:

Lawyers evaluation		Raskin's evaluation	
Guilty 47		Guilty (positives) 39	
		Innocent (negatives) 1	
		Inconclusives 7	
Innocent 17		Guilty (positives) 6	
		Innocent (negatives) 5	
		Inconclusives 6	

When inconclusive cases were eliminated and the guilty and the innocent cases were set up to be equal in number in this study, positive evaluation occurred in approximately 71% of the cases, and false positives in 36%.

11.3

Raskin, D. C. and J. A. Podlesny. "Truth and Deception: A Reply to Lykken." Psychological Bulletin, v. 86 (1), 1979, 54-59.

11.3.1 CQT Theory

In a test that follows a detailed pretest interview, guilty subjects will show relatively strong autonomic responses to relevant questions. On the other hand, innocent subjects show relatively strong responses to control questions, because the same general characteristics that work on relevant question work equally on control questions.

Innocent subjects know that their answers to relevant questions are truthful. They are made to believe that control questions are very important in the evaluation of their sincerity. For innocent subjects informed by pretest explanations and also by wording devised so that they answer "No" to control questions, such questions act as very strong stimuli.

Therefore, the true aim of control questions is to positively distinguish an innocent subject by providing stimuli that elicit stronger autonomic responses in them than in relevant questions.

11.3.2 Empirical Issues

Lykken ignores the effectiveness of experimental studies that serve to estimate the accuracy of the polygraph test in real life polygraph applications. This fact indicates his insufficient understanding of scientific methods as well as the value and multitude of controlled experiments available (Hempel, 1966).

Recent strategy aims to "perform experimental studies along the line of real life validity and in as close a real life context as possible."

Lykken's emphasis on the necessity of a blind analysis of polygraph charts in determining validity is correct. Regrettably, he erred in interpreting correctly two studies of his own choice. He also failed to touch on five studies that meet his criteria but present powerful evidence that refute his stand. The results of these studies are presented in the table below.

Table 1

Table 1
*Percentage of Correct Decisions in Five Studies
 With Blind Interpretations of Polygraph
 Charts Obtained From Verified Guilty and
 Innocent Subjects*

Study	Guilty	Innocent
Horvath & Reid (1971)	75 ^a 89 ^b	83 ^a 94 ^b
Hunter & Ash (1973)	88	86
Slowik & Buckley (1975)	85	93
Wicklander & Hunter (1975)	95	93
Raskin (Note 3)	93 ^c 100 ^d	69 ^a 95 ^d
Combined results	90	89

^a Decisions were made by intern examiners.

^b Decisions were made by experienced examiners.

^c Evaluation was nonnumerical.

^d Evaluation was numerical.

Reliability and validity of blind analyses of test records performed by competent examiners trained in appropriate record interpretation and evaluation free from observed behavioral symptoms are extremely high.

Results obtained by examiners trained to evaluate from behavioral symptoms rather than from analysis of test records are worse than chance (Horvath, 1977).

11.3.3 Problems in CQT Applications

We concur that data indicate more frequent false positives than false

negatives by CQT, though either case occurs only rarely.

Positive evidence is required to obtain conviction in criminal cases. Results of the polygraph test are not sufficient as such evidence. In cases in which no counterevidence exists to refute the fact, however, results of the polygraph test serve as sufficient evidence to eliminate suspicion because the accuracy of the evaluation of "innocence" by polygraph testing is extremely high.

12. Procedures for Polygraph Testing Exercise

A Time distribution

1:00-1:30 p.m.	Test room set up
1:30-2:00	Questionnaire development
2:30-4:00	Testing
4:00-4:50	Analysis of test results

B. Procedures

1. Trainees are divided into two groups. Test records are analyzed to identify the one criminal to be found in one group. Practice testing is performed on trainees assigned to the other group
2. Based on group consultations the group as a whole develops question lists, one CQT and three POT. The control question in the CQT is: "While you were in high school, did you ever steal anything that belonged to someone else ?" POT lists consist of seven questions. As a rule, critical questions are placed at the 2-6 position in the list. The same question list is repeated three times.
3. No pre-test interview is necessary. Each trainee will be in charge of one examinee in the other group and presents all the question lists developed.

4. Each trainee is responsible for evaluating the test records that he/she has obtained and reports the results to other group members. After consultation, the group identifies the criminal in the other group.

C. Case outline

Time: February 14, 1986

Place: Library Reading Room, National Research Institute of Police
Science

Stolen item: 580,000 yen in cash (58 10,000 bills)

The cash was placed in an envelope stamped with the name of the Seibu Savings and Loan Bank. Written in the upper part of the envelope was: "To Mr. Tazaki, total of 580,000 yen". The envelope was placed in a tin box, bearing the name, "Izutsu Yatsushashi" [the name of the manufacturer of cinnamon flavored classic cookies]. The box was in a navy blue shopping bag.

After reading a newspaper in the reading room, the victim left the bag on a chair there.

13. Themes for Development of Questionnaires

Develop one CQT and five POT lists for each theme incorporating contents of the theme.

Theme 1

- 1 Time of the incident: from around 1:00 p.m. to around 1:20 p.m. on September 24
- 2 Place of the incident: Printemps Western Confectionery Shop, Kikuyoshi-cho in the city
- 3 Case outline: Someone stole part of the sales receipt, 190,000 yen (ten 10,000 yen and eighteen 5,000 yen bills) from the Printemps Western Confectionary Shop. The store manager (male, 36 years old) was responsible for the receipts. The manager was counting the morning's sales in the afternoon, but around 1 p.m. he had to go to the front of the store to resolve a problem with a customer. When he returned to the office 20 minutes or so later, he discovered the theft. The manager immediately got in touch with the main office for instruction so that details of the case did not leak to anybody else. Before going to the front of the store, the manager gathered the 10,000 and 5,000 denomination bills that he was counting and placed them in a paper bag at hand on which the name of Wako Confectioner was

printed. He opened the uppermost drawer of the filing cabinet that stood in the deep right hand corner of the office, then, placed a camera (Cannon F1) found in the drawer over the paper bag, that contained the cash, as a weight.

4

Examinee: During this time period, any one of four female employees could have left their work place and entered the office. However, with the exception of A (from W City, T Prefecture; graduate of F High School; born in 1962), it was almost certain that others did not go near the office.

A has been working at the store for approximately five months. While cheerful in nature, she has the tendency to boast about her possessions. At present she is cohabitating with a man (a 20 year old student), that her parents oppose her marrying, in the Rene Apartment House in Kakizaka-cho in the same city. She has boastingly told this fact to her friends and coworkers at the shop. Once she displayed a French scarf to her friends and told them that she shoplifted it from a department store.

Before A started to work at Printemps, she worked at The Wagon Coffee Shop as a waitress. While she worked at this place of previous employment, it came to light that she took a purse that contained 5,000 yen in cash from a coworker's

handbag and she was summoned to a police station to explain the circumstances. At that time, however, no punishment was dealt out; only a warning was issued.

- 5 Statement of the person in question: I have heard that money is missing, but I don't know how much. It is annoying if we employees are under suspicion. Please do a thorough investigation. I'm willing to take a lie detector test. I have never stolen before. I have never been in any trouble with the law.

Theme 2

- 1 Time of the incident: from around 3:30 p.m. to around 4:00 p.m. on October 9
- 2 Place of the incident: In the vicinity of a town road that goes through a forested mountainous area Kakiuchi-cho in the city
- 3 Case outline: As the victim (a 17 year old 11th grader) crossed the aforementioned area where both sides are forests on her way back home from school, she saw several logs, approximately 10 cm in diameter, were scattered on the road. Since she judged the road to be impassable, she got off of her bicycle, and tried to push the logs away to the side of

the road. Then, she felt someone behind her and turning, saw a man wearing a baseball cap was standing close to her. The lower half of his face was covered by a large mask like device. Surprised, she stood frozen. All of a sudden the man held her close and tried to drag her into the forest. The victim screamed and resisted. However, the man was powerful and she was dragged into the forest 20-30 meters. The man pushed the victim down, pinned her body down lying upon her, and began to grope under her upperwear and skirt. The victim flapped her limbs wildly and screamed. The man began to push his handkerchief into her mouth. At that time, the sound of a car horn was heard from the direction of the road. When the man's power slackened, the victim removed the handkerchief from her mouth and yelled. The man jumped up and ran away deeper into the forest.

Results of the Investigation:

- (1) A used bicycle of unknown ownership was hidden in a thicket about 50 meters from the place of the assault. It could be that the criminal left the bicycle there to use for a getaway.
- (2) The victim's statement: "I don't think I have seen the man before. He did not appear to be so young. He was not so tall. He appeared to be rather stout. He wore something that looked like work clothes."
- (3) Inference leading to the suspect: The owner of the

bicycle near the site turned out to be N.M., a farmer in the next town. However, N.M. himself had a perfect alibi. Besides, this bicycle had not been in much use and was always left standing at the entrance of a barn. Since family members were for the most part away from home during the day, nobody knew who might have borrowed it without permission.

5 Examinee: K.S. (30 years old). K.S. lives near N.M., the owner of the bicycle. Presently he is helping out as a painter. He is the third son of a farmer. He has held a variety of jobs up to now. While he was away from home at one time, he is back at home as of late. When there is work, he goes into town; when not, he helps with farming.

He is single. At one time, he lived with a woman. While intoxicated, he injured the woman he was living with by striking her. About a month ago, there was an uproar over the case of a man who sneaked into the place of an unmarried woman (S.T., 32 years old) in town and committed an indecent act. The victim, S.T., as well as people in the neighborhood who chased after the man gossiped that K.S. was likely to be the man who ran away from the place. This case was not reported to the police.

6 Statement of the person in question: "I have heard of a

high school student who was assaulted on a mountainous road. Since I don't read newspapers, I don't know the details. On that day, I took bus to the station area and played pinball games."

Theme 3

- 1 Time of the incident: from about 9:30 p.m. to about 10:00 p.m. on July 4
- 2 Place of the incident: The dressing room of "North Pole" sauna in Fuku-machi in the city
- 3 Case outline: While the victim (owner of sporting goods shop, 35 years old) was semi-awake in the sauna, he felt as if someone touched his hand. Opening his eyes, he saw a young man sitting close by. He had seen the young man, one of the regulars, on occasion but had not spoken with him. As if feeling a reproachful air, the young man apologized lightly, "Pardon me," stood up, and left the sauna.

The victim returned to a half-awake state. After 10-15 minutes, he happened to glance at his wrist to notice the key to the locker, which he wore on the right wrist, was missing. Looking around, he could not find the key. Remembering the young man he saw earlier, the victim

hurriedly left the sauna and went to the front of the locker that stood lining the dressing room wall. The lid of locker No. 39, the number he remembered, opened easily, despite his memory of having locked it securely. Feeling under the pile of clothing, his wallet with 350,000 yen in cash was missing.

4

Results of the investigation: On the basis of statements from sauna employees and that of the victim, the "young man" was identified as S.T., who works at the restaurant about 100 meters from the "North Pole" sauna. When questioned, the young man admitted that he frequented the sauna. However, he stated that because on the date of the crime he was off from work, he visited the sauna around 7 p.m., returning to his apartment around 8.

The key to locker number 39 was found abandoned in the planter of a rubber tree in the entrance hall of the "North Pole" sauna. The stolen wallet was found abandoned in a plastic bucket left on the street in front of the "Parisienne" tea room, on the same side of the street as the "North Pole" sauna.

5

Examinee: S.T. (a 21 year old cook) lives with a 23 year old woman in the "Plaza" apartment house in Tenjin-cho of the same city. The woman works at a tea room. Both are

working, but their salaries are modest. However, S.T. likes to gamble and owes a considerable sum to his friends. Particularly his friend K, who asked him to hold the money from the sale of K's car, is now pressing him to return part of the money, 80,000 yen, that he had spent on himself. Also confirmed is the fact that he occasionally takes out food from the restaurant where he works to sell to his acquaintances.

Theme 4

- 1 Time of the incident: Approximately 10 a.m. on December 17
- 2 Place of the incident: On the street in Shiodome-cho in the city
- 3 Case outline: E.F. (a 36 year old female wearing a beige dress and low-heel shoes of the same color), a clerical employee of Honshu Industry Inc., was on her way back to the company with 1,156,000 yen in cash in her shoulder bag, money that she just had withdrawn from a bank. Suddenly, a man wearing a ski cap and sun glasses jumped out from behind a parked passenger car on the street and silently thrust a blade at E.F.'s breast. The criminal took the bag with cash away from E. F. who just stood there petrified and unable to speak, by this sudden incident. He jumped into a car with

its engine still idling and drove away.

4 Results of the investigation:

(1) Judging from the fact that the criminal had hidden the getaway car near the site of the crime, he must have been quite familiar with the internal workings of Honshu Automobile Inc. and known that E.F. worked there as an accounting clerk frequently making trips to the bank to deposit and withdraw money. Particularly his hiding of his face and remaining silent throughout suggest that E.F. could have identified him had she seen his face or heard his voice.

(2) The stolen cash was in a paper bag printed with the name of the Fuku-machi Sogo Bank, further wrapped in a brown cloth, and placed in the black shoulder bag.

(3) The getaway car was a Honda Civic: The lower two digits of the license number were 35. However, the car turned out to have been stolen the night before the incident from a parking lot of the Yasukura [?; the second character not identified] Housing Development in the city. The owner of the car reported the theft the morning of December 17.

5 Examinee: J.K. (a tea room manager, 45 years old) worked in the business section of Honshu Automobile Inc. until about

five years ago. He was fond of gambling, had a bad service record, and did not get along well with his superiors so that he quit the company. Thereafter, he had successively owned and managed a Mah-Jongg parlor and a snack bar; at present he runs a tea room. Because his gambling associates lounge in the tearoom all the time, general customers do not often come in. Therefore, the business cannot be said to be prospering. In addition to owing a large debt to his wife's family, he has borrowed money at a high rate of interest from an acquaintance. He has no prior record. While he is in fact a cowardly person, he tends to brag and once drunk, tends to be violent. He has been summoned by the police a few times after fighting with acquaintances. He is something of a pettifogger who likes to take on the job of intermediary in traffic accident cases. As a result of the investigation, blackmail of 560,000 yen from T.O., a white collar employee responsible for injuring a person in a traffic accident, came to light: The examinee extorted the sum by pretending that he was acting at the victim's request.

6 Statement of the person in question: I have not done anything that I feel guilty about when investigated by the police. I have done nothing shady.

Theme 5

- 1 Time of the incident: from approximately 12:15 to
 approximately 1:00 p.m. on March 24
- 2 Place of incident: Office of the Fukuyama Agricultural
 Union, Fukuyama-cho in the city
- 3 Case outline: During the time period above, the office was
 completely empty due to several chance factors that combined
 with many absences on that day. That afternoon, M.T., the
 cashier, locked the safe up in the office after placing
 780,000 yen scheduled to be taken to the bank. At that
 time, the Accounting Section head confirmed the locking up.
 When M.T. returned from lunch, M.T. thought of going to the
 bank, but could not find the key. The safe was found
 unlocked and the theft of 780,000 yen in cash was
 discovered.
- 4 Results of the investigation:
- (1) The cash, 780,000 yen, was divided into three bundles,
 500,000 yen, 200,000 yen, and 80,000 yen, respectively. The
 bundle of 500,000 yen consisted of all 10,000 bills, placed
 in a white envelope, on which "fertilizer sales receipt" was
 written with a black marker. The 200,000 bundle, also all
 in 10,000 bills, was placed in an enveloped marked "the
 Manpuku Credit Bank."
- (2) All the bundles were placed in a green bag of synthetic

leather (20 x 25 centimeters); embossed in gold on the outside was "the Kofuku Credit Bank").

(3) The interior of the safe was divided into five shelves. The bag with cash was placed on the shelf second from the top.

(4) The key to the safe was kept in a wooden box on the section head's desk. Everyone in the section knew where the key was, but anyone not belonging to the section was not supposed to know this. Besides, the box was to be out on the desk only during the daytime, when section members are around. However, when the theft took place, nobody happened to be nearby.

(5) A search of the neighborhood yielded the bag in the incinerator in the back of the agricultural union building. The money, however, was missing.

5

Examinee: Since three years ago, T.A. (40 years old) had been working for the union as a warehouseman. Because of the nature of his work, he rarely entered the office where the safe is placed. At least, he stated that he had not entered the office the day that the crime took place. However, testimony was obtained stating that during the time period a witness saw him from the back walking along the first floor corridor where the office is located.

T.A. was born the third son of a wealthy family in this

town. After graduating from high school, he moved to the city, the prefectural capital, working for a company. Three years ago, he quit the company, returned to Fukuyama-cho, and began to work at the Fukuyama Agricultural Union, a job his eldest brother found for him.

He married while he was a company employee, but is childless. His resignation from the company was supposedly due to poor health. The real reason, however, was money-related trouble. That is, he loved gambling, especially betting on horses, which sucked up most of his income. Household expenses were mostly paid by his wife who owned a dress making shop. As his wife did not earn much, T.A. personally frequently borrowed money and was at the end of the road. From around one year before T.A. quit the company, incidents such as wages still in envelopes stolen or a missing, company-owned camera occurred frequently. Circumstantially, some suspected that T.A. was the criminal. Approximately one month before his resignation, the theft of a company computer, which T.A. had sold, was discovered. His superior told T.A. to voluntarily resign in exchange for overlooking the theft. On the excuse of health problems, T.A. resigned from the company and paid his debts off with his severance pay.

6 Statement of the person in question: "I have heard of the money

stolen. Because I don't have anything to do with office work, I don't know any details. During the lunch break when the thief entered the office, I was reading a newspaper in the library.

The reason why I resigned from the company I used to work for? I have a liver problem. I came back here choosing a job easy on my body."

Theme 6

- 1 Time of the incident: Approximately 3 a.m. on April 25
- 2 Place of the incident: S.Y.'s home in Inada-cho in the city
- 3 Case outline: While the victim, S.Y. (46 years old), was asleep next to his wife, N.Y. (38 years old), in his eight mat size residence, he was awakened by a male intruder, who suddenly hit S.Y.'s head. Woken up by the commotion, N.Y. ran outdoors and screamed. The criminal ran away without taking anything.
- 4 Results of the investigation:
 - (1) The criminal entered through the kitchen door, which was left unlocked.
 - (2) The sudden blow on the head suggests a grudge, rather

than burglary, as the motive for the invasion.

(3) The criminal brought in a rather old wooden baseball bat, which was found lying outside the kitchen.

5

Examinee: Until three months ago, H.I. (a 38 year old taxi driver) lived in a room in the apartment building owned by the victim, S.Y. About three years ago, H.I. moved in with his wife (32 years old) and a son (5 years old). Approximately one year ago, H.I. became intimate with the landlord's wife N.Y. and appears to have become her lover. This was virtually confirmed, because other residents of the apartment had seen the two spending several hours together in an empty unit of the apartment. Since the time the wife had come to know about this, the couple quarrelled constantly. At one time, the wife went away to live with her family. Recently, however, N.Y. has begun to take a cold attitude toward H.I., due to his habits of drunken viciousness and being a spendthrift. Rumor had it that H.I. had moved out because of his fight with N.Y. over her coolness. However, H.I. denies a liaison with N.Y. At present he works as taxi driver. Last month he was overheard boastfully telling of his short temper to coworkers, that he had hit and thrown out of his taxicab a drunken customer who had picked a fight with him.

6

Statement of the person in question: I have never returned

to that apartment since I moved out. Therefore, I have nothing to do with the landlord's injury. There are no grounds for suspecting my having relations with the landlord's wife. People seem to gossip that I chased after the landlord's wife. I am annoyed by such irresponsible rumors. The reason for my wife's staying with her family was because of her poor health so that the family can babysit for the child when she visits the hospital clinic.

14. Test Procedures

14.1 Preparations Before Question Presentation

14.1.1 Consultation With the Investigator in Charge

Polygraph testing begins with a consultation with the investigator in charge. Discussion is held over the telephone or face-to-face regarding the outline of the case, all information about the examinee, and time, date and place of testing, as well as a request to have the letter of commission sent, the acquisition of the examinee's consent document, and the problem of observers.

14.1.2 Explanation of the Case Outline

In consultation with the investigator in charge, listen first to the explanation of the case outline. The first stage of preparation for testing is the acquisition of knowledge about the case contents so that a decision can be reached whether the case appropriately meets the conditions for a polygraph test. For example, the problem of whether questionnaires can be developed must be examined. Secondly, based on the case outline, procedures for gathering materials for the questionnaire development must be decided on.

14.1.3 Conditions Concerning Examinees

Ascertain the examinee's sex and age; a male or female. If a female, determine whether she may be pregnant. The sixth article of the current compendium of the polygraph test administration lists prohibits the testing of "those who are pregnant." Therefore, if the examinee scheduled for testing happens to be pregnant, she should not be tested. However, Article Six does not pose any limitation as to the age of examines. Practical determinations are made regarding maximum and minimum age limitations. First, a cut off criterion for the aged is tentatively set at age 70. At that age, examines have a high probability of suffering from chronic diseases, such as hypertension. Also they have a tendency to be insensitive to external stimuli. Therefore, regardless of an examinee's involvement with the case tested, easily discernible physiological responses to stimuli (questions) cannot be expected. Another type of problem exists with the young. Because no criminal responsibility applies to children under the age of 14, they cannot be subjected to polygraph testing. When a youth between the ages of 14 and 19 are to be examined, special considerations must be paid. In principle, those still in the compulsory education system are not considered to be subjects for polygraph tests. As to those who have completed compulsory education, polygraph testing is given after obtaining their guardians' consent document, in addition to their own document of consent; this is to guarantee the voluntary nature of the test taking. As to those who hold a job after the completion of compulsory education, the guardian's document of consent is hard to obtain because many live away from their guardians. In such cases, the polygraph test is given

after obtaining the consent document from a person who is in a position to supervise the youth, e.g. the employer, to guarantee voluntariness. No special considerations are given to youths above the age of 19, but younger than 20: The test is administered after obtaining a document of consent directly from the examinee himself/herself.

It is necessary to ascertain that the examinee does not fall under Article Six of the current polygraph test compendium as described above as inappropriate for a polygraph test.

14.1.4 Date and Place of Test

After the test commission has been accepted it is desirable to do the testing as soon as possible. A date is picked with the consideration of allowing enough time for pretest preparation.

It is desirable to choose a place devoid of any conditions that might interfere with a polygraph test. When a test is to be given inside a police station, inquire about the condition of the testing room and make an effort to meet the following conditions: a) No outside noise should be audible, b) no third party should enter the room, c) no voice from the next room or telephone rings should be heard in the room, d) no telephone should be present in the room, e) there should be little traffic in the corridor outside the room (this problem can be solved to some extent by posting a sign in the corridor to the

effect: "Test in progress; please be quiet"), and f) no decorations that suggest a police atmosphere should be present (in other words, there should be no visible object that distracts the examinee's attention. At the least the examinee's chair should be placed to face a wall without pictures, photographs, or a calendar).

14.1.5 Request for a Test Commission

The examiner requests to have a test (evaluation) commission document sent. The main entries in a test commission are: a) case title, b) time of the incident, c) place of the incident, d) victim's name, address, occupation, and age, e) examinee's permanent place of domicile, address, occupation, and age, f) test (evaluation) items, g) reason for the test, and h) outline of the case and other matters of reference.

14.1.6 Acquisition of Consent Documents for the Test

In giving a polygraph test, voluntariness on the part of the examinees must be respected. Therefore, a consent document is requested beforehand. The consent document is obtained through the investigator in charge of the case being examined. First, the investigator in charge briefs the person to be examined on the polygraph test and obtains his/her agreement and a consent document. Then, after the examiner administering the test has given an explanation of its outlines, from his point of view, to the examinee in the course of the

pretest interview, the examiner ascertains the examinee's willingness to be tested by being shown the consent document.

14.1.6 [sic] Observer

Whether or not an observer is required depends on the type and situation of the scheduled examinee. The need for an observer, as well the person to serve as one, must be agreed upon beforehand. Observers are not necessarily required for male examinees. However, if the examinee is a woman, the presence of a female observer is desirable. Therefore, make a request to obtain the collaboration of a female staff member.

14.1.7 Questionnaire Development

Main sources of material for the preparation of POT (the critical question test and exploratory test) and CQT are: documents, such as depositions, the investigator in charge of the case, the victim, and records of observations about the scene of the crime, etc.

14.1.8 Depositions and Other Documents

Documents such as depositions and onsite photographs need to be studied first in order to grasp the outline of the crime in question. Moreover, material for the preparation of important questions can be extracted from these documents. However, because such deposition

documents were not originally prepared for the purpose of developing polygraph questionnaires, not all needed material can be extracted from them.

14.1.9 Investigator in Charge of the Case

A consultation with the investigator in charge is held to obtain information for the development of question lists. At this time, authenticate details in such materials as depositions and obtain information regarding the progress of the investigation of the scheduled examinee. This procedure is important in determining the items to be used as critical questions in the POT questionnaire. Another purpose of the consultation is to confirm whether the contents of critical items drawn from deposition documents tally with the detailed facts of the case. Following this, confirm whether in the course of the investigation the scheduled examinee could have gained knowledge about the contents of critical questions. Also suitable materials for control questions in CQT questionnaires can be obtained through discussion with the investigator in charge.

14.1.10 The Victim

When an interview with the victim is feasible, effective material for the development of questionnaire can occasionally be found among the detailed facts about the damage suffered by the victim. Especially in cases that involve other parties, e.g. violence, injuries, and sexual

crimes, observations on peculiarities of the criminal's behavior in the course of the crime can be used as content for critical questions in the POT questionnaire.

14.1.11 Observation of the Scene of Crime

Along with interviewing the victim, the scene of the crime should be observed as much as possible. As the observation is done from the viewpoint of a polygraph examiner, this will be an opportunity to obtain surer and more effective materials for questionnaire development that differ in character from indirect materials such as documents, or information obtained from the investigator. In doing so, it is important to share the criminal's point of view as much as possible. That is, imagine what state the site was in at the time of crime and guess what the criminal would have seen, heard, touched, what would have given off a relatively strong impression, and what would be remembered clearly.

14.1.12 Questionnaire Development

POT and CQT questionnaires are developed based on materials gathered beforehand. The optimal testing time will be approximately two hours, taking into consideration fatigue and other factors on the part of both examinee and examiner. This time limit determines the standard number of question lists administered to be one CQT and 7-8 POT lists.

14.1.13 Questionnaire Development and Equipment Check

Ascertain whether the test room is in order suitable for polygraph testing. To begin with, sit on the examinee's chair to see whether any distracting object comes in sight. Examinees usually sit next to the test equipment, but movement of recording pens and paper should be outside their view. Also pay attention to ventilation and room temperature, bearing in mind seasonal variability.

Ascertain beforehand that the testing equipment is in perfect working order.

14.2 Testing

14.2.1 Interview Prior to Questioning

An interview is conducted with the examinee prior to presentation of questions. This interview serves as introduction to the test, establishes rapport with the examinee, and explains how the test will be conducted.

14.2.2 Introduction to Testing

At the beginning of testing the majority of examinees are tense. An appropriate level of tension works positively in enhancing test effectiveness. However, unnecessarily extreme tension or anxiety

makes examinees psychologically restless, causing meaningless confusion in the physiological responses being recorded along with question presentation, and may result in inability to obtain records that are easy to evaluate. Examinees often equate polygraph testing with "lie detection" and, from the name, understand it to be something that "intrudes deep into their minds" and may vaguely fear that all their privacy will be exposed. From unknown reasons other than the above, examinees may maintain unnecessarily extreme tension or anxiety.

Introduction to testing is intended, among other aims, to reduce such extreme tension or anxiety. First, an explanation of the situation is given or one has the situation explained. If possible, let the examinee explain. By asking "Why did you come here?", examinees are made to begin to speak. From this conversation, the examiner comes to understand how the examinee regards his/her association with the case under investigation or how he/she wishes to explain his/her association. In many cases, examinees' explanations are not complete but their tension can be eased by having the opportunity to explain the situation they have found themselves in.

The examiner supplements the examinee's version of the explanation about the situation. The examiner explains the objective situation, especially the examinee's degree of association to the case to be tested. This consultation aims at making examinees come to a full understanding of taking polygraph tests.

Explanations about the polygraph testing itself are also given during

this interview. Explanations of the equipment, how testing will be performed, and what the tests achieve, are given in easy to understand language.

After explanation of the polygraph testing, the document of consent obtained beforehand is presented to the examinee to confirm that it has been written out of the examinee's own free will.

At this stage of the interview, the examinee's physical condition is checked. Check their recent normal state of health and, whether they have been sick during the last two years, identifying the name of any disease. Especially if an examinee is suffering from neurosis, the probability of current use of a tranquilizer is high. Manifestation of physiological responses is weak under the influence of tranquilizers. In addition, ask about the quality and depth of last night's sleep. Some examinees sleep during the test because of lack of sleep. Even if the subject is not fully asleep, in a drowsy condition physiological responses appear actively to any and all stimulation. When checking, such things as the examinee's physical condition, the danger of missing some points will be prevented by preparing a check list beforehand.

14.2.3 Establishing Rapport With Examinees

1) Polygraph testing is based on the examinee's cooperation. It is impossible to perform polygraph testing if the examinee just sits

around immobile and does not respond appropriately to the examiner's questions while physiological responses are measured and recorded. Rapport with examinees is important in gaining their cooperation.

Firstly, the examiner makes clear his/her attitude of attempting to take an objective stand toward the examinee as much as possible, of trying to eliminate preconceived ideas or prejudices, and of endeavoring, with the cooperation of the examinee, to use the polygraph equipment to discover the truth.

Most examinees insist, "I am not connected with the crime and it is a nuisance to have become a suspect." The examiner should display an accepting attitude toward these types of contentions of the examinee. The examiner answers, for example: "It certainly may be as you say, but it is difficult to prove. The polygraph test can provide grounds for deciding that you are speaking the truth. There is nothing to worry about, just cooperate with the test."

When the examinee wants to explain his/her stand, it is better to try to listen. Some examinees, however, attempt to talk at length about unrelated matters. In such cases, advise the examinee to discontinue.

In this way, through a discussion between the examiner and the examinee, rapport is established, and smooth progress of test procedures can be expected. If the examinee does not have anything to do with the crime in question, he/she will actively follow the

examiner's directions and cooperate so that test records that are easy to evaluate can be obtained. Smooth progress also will result even with an examinee who has actually committed the crime and has been hiding it while assuming a surface attitude of cooperation with testing.

2) Establishing rapport with the examinee is more difficult because an interview in polygraph testing is a fairly unusual situation. The examiner may encounter hindrance during the process of establishing rapport, as well as during the test itself, in the form of examinee resistance, especially with an examinee who has actually committed the crime and has been hiding it. In this case resistance is often not an overt one but takes the form of a psychological reluctance that appears in the examinee's manner of speech or attitude. Therefore, an interview must start with an effort to weaken this type of resistance. The most important condition, in this case, is a guarantee as to the individual's privacy. Judging from our own personal experience, when people plan to talk about intimate matters they choose an appropriate place for it. Nobody chooses to confide a secret standing on a busy street. For this purpose people must choose an isolated, quiet place during a calm evening or night, a place where there is no fear of interference by a third party. Based on this psychological mechanism, Inbau and Reid, in their book on polygraph testing, emphasized the importance of maintaining privacy in a test situation. In such a situation, it is necessary at the very least to lead the examinee's interest to concentrate on the situation at hand in which he/she will

not be able to maintain the composure necessary to intentionally exert psychological resistance. For this purpose a room specially prepared for polygraph testing becomes necessary. As stated previously, a room free from extraneous noise is desirable. This is the reason why one of the conditions for such a room requires that there should be no telephone present. Nothing is more effective in disturbing the good atmosphere for interviewing than a telephone call that comes without warning. If a telephone rings during an interview and the examiner answers, the rapport established up to that point may be aborted. A telephone ring after the beginning of question presentation naturally also interferes with testing.

The examiner must use the vocabulary that the examinee uses and understands in daily life during the interview in the polygraph test situation. Depending on the level of the examinee's responses, employ easy and simple expressions. When the examinee uses slang or a dialect, the examiner [sic: examiner?] should use similar expressions as long as he/she does not sound unnatural. Doing so does not hurt the examinee's dignity. Rather, the use of the same words or expressions in an interview indicates that the examiner stands on the same ground as the examinee. So, good rapport can then be established.

14.2.4 Record Taking During an Interview

The content of the examinee's statements, expressions and bodily

movements need to be recorded in as much detail as possible during the interview. Apart from posing questions to confirm contents of the examinee's statements, the examiner must absolutely avoid emotional refutations or accusations. There are two goals for record taking: the first is to express an attitude of acceptance of the examinee's stands and contentions. The fact that the examiner listens to examines' stories in earnest and pays attention by taking notes indicates his attitude of acceptance of the examines' stands and contentions. Regardless of the examinee's association with the case under investigation, this attitude on the part of the examiner is conducive to creating on the part of the examinee a favorable feeling and sense of reliability toward the interviewer. Another purpose is that, based on records, examiners can point out discrepancies or contradictions in examines' contentions and have them change their attitude if in the middle of testing they change their position, become uncooperative, or intentionally attempt to confuse the record.

14.2.5 Choosing and Discarding Question Lists

During the course of this interview with an examinee adequacy/inadequacy of the contents of the questionnaire prepared beforehand is determined. Firstly, ascertain the extent of knowledge the examinee has about the content of the crime that is the object of the test. In doing so, have the examinee talk as much as possible. Because many examines are not accustomed to talk systematically, the examiner may need to provide cues. Examples of questions used as

cues, intended to set examinees to talk about concrete matters, are: "What do you know about the victim?" or "Do you know what was stolen?" "Cue" questions address critical questions in POT questionnaires. In this way, the examinee's detailed knowledge of the case is ascertained. There are extremely rare examples of examinees who, while innocent, happen to have detailed knowledge of the case and may have the misunderstanding that "If I say I know something that only the criminal knows, I may be thought to be the real criminal" and insists "I don't know" about what he/she in fact knows. Therefore, it is necessary to add, "Please tell what you know, even if you did not directly see it, things you heard from investigators or from television or newspapers." Another problem is highly accurate guesswork. Even when lacking knowledge about detailed facts of the case, a guess inferred from circumstantial situations may be made with high accuracy. If such a possibility exists, the point must be confirmed by posing examinees such questions as "Is there anything that you have imagined?"

As described above, the examinee's "knowledge" about detailed facts of the case under investigation is checked. If the examinee knows the contents of critical items in the POT questionnaire prepared beforehand, the POT question list naturally cannot be used. Therefore, POT question lists to be presented to the examinee are determined at this stage.

14.2.6 Examinee's Attitude

1) By observing examinees' movements and expressions during the interview, examiners are to attempt to guess what examinees are thinking and what they are feeling. The most common characteristic displayed is a nervous attitude, expressed in restless bodily movements. As it is probably the first time the majority of examinees have experienced polygraph testing, examinees may naturally behave somewhat restlessly from anxiety about the "lie detector." However, the attitude of examinees who are in such a psychological state generally stabilizes as they come to understand the test procedures when they are explained.

Some examinees express the fear that, since they are timid or nervous, examiners may reach erroneous conclusions. In such a case, the examiner should explain fully that "timidity or nervousness" is not a contributing factor in making erroneous decisions. Examinees usually are satisfied with this explanation and do not return to this problem. However, if there is one who repeats this concern, follow the simple feedback procedure below: First, let the person assume a comfortable posture and measure and record breathing or SRR with eyes closed. As long as the examinee does not intentionally attempt to disturb his/her responses, within 5-10 minutes the pattern of breathing waves will become uniform and spontaneous SRRs will subside. While there is no need to show the recording to the examinee, the examiner can with confidence explain that the examinee has returned to a state suitable for testing.

Though rarely, some examinees display anger. No matter what the real reason may be, on the surface dissatisfaction for being treated as an examinee despite the free consent he/she has given, or anxiety at being tested, may be expressed as anger. When test procedures are explained, such examinee dissatisfaction or anxiety for the most part disappears. However, some of the examinees who have participated in the crime and are hiding the fact, may bluff and continue to display anger. In such a case, it is essential that the examiner remain cool to cope with the situation and objectively explain the situation that the examinee is in. One such method is for the examiner to address the examinee, "You may feel unpleasant, but let's try to dispel suspicion by working together," emphasizing that the examiner understands the situation the examinee is in, as well as how he/she feels. Also it is necessary to some extent to listen to the examinee's discontent.

Some examinees show curiosity about the test equipment. They may pose such questions as: "Will I get electric shock?"; "How are the records taken?" Politely explain the equipment to the examinee in general. However, no detailed explanations are necessary.

14.3 Recording of Measured Responses

14.3.1 Recording Procedures

At the beginning of record taking, a few procedures must be followed

in order to obtain easy to evaluate test records. One of conditions for obtaining such records is a cooperative attitude of examinees. The following, therefore, are procedures for obtaining such a cooperative attitude.

14.3.2 Explaining the Measuring Equipment

1) Explanations about attaching electrodes and other measuring equipment are given during the period between the interview and question presentation/record taking. One method is to include the explanation about the functions of measuring equipment as a part of the interview. That is, during the first half of the interview, examinees are asked to explain in general the scope of their knowledge of the case being examined. This is an attempt at making examinees themselves realize, in the course of the interview, where they stand in relation to the case. The following is an example, a case of theft in a workplace.

The following is recommended. "As you have told me right now, cash was found missing at your company. I'm sorry to say it, but in the eyes of a third party, you are in a situation to be considered a suspect since you were one of the persons who happened to be working near the site of the theft. You yourself have said that this was regrettable. It certainly can be termed a misfortune for you. You mentioned that you want to prove that you have nothing to do with the case as soon as possible. Therefore, by having you take this

polygraph test, we will prove your innocence. A polygraph test is . .
."

2) Explanations given while attaching electrodes may be easier for examinees to understand. One-sided explanation full of technical terms in psychophysiology may elicit groundless anxiety on the part of examinees, since they fail to understand it. Therefore, it is important to give easy-to-understand explanations that cite examples experienced in daily life. For instance, make examinees recall in what situation they have experienced such phenomena as "sweaty palm," "pounding chest," or "blushing" and then explain the relationship between emotion and physiological responses, choosing simple, easy-to-understand words.

14.3.3 Adjustment of Response Recording

Adjustment of response recording is done using the most convenient method based on the examiner's knowledge and experience. The aim of this procedure is the acquisition of the best records possible that will allow the making of clear decisions. Described here for reference is a standard procedure.

Breathing waves are adjusted first. First, start running the recording paper. Attach the pneumograph on the examinee's chest (or abdomen) and observe the breathing waves being drawn on recording paper. A breathing wave amplitude of 1-2 cm is the wave amplitude

easiest for evaluation. In order to maintain stable breathing waves within this range of amplitude, adjust the position of the pneumograph as well as the tightness of the fastening chain.

Next, attach the SRR electrodes. The most common method used is to apply a thin coat of paste over electrodes and fix them at the first finger joints (palm side) of the second and fourth fingers respectively with a piece of magic tape. This part often sustains cuts or abrasions. Even small scars cause lowered epidermal resistance and cause short circuiting so that skin resistance decreases abruptly. Therefore, this part must be fully inspected before attaching the electrodes. When artifacts occur frequently, a small scar at this place should be suspected. Change the finger or use the finger's second joint to attach the electrode.

Salts left by evaporated sweat remain on a palm. These salts often act as the cause of artifacts. Therefore, it is necessary to wipe away salts at the site before electrodes are attached, using distilled water.

When spontaneous responses occur frequently before question presentation, let examinees assume a relaxed posture with eyes closed for several minutes to calm them down. Even if frequent spontaneous responses occur, the session may begin without waiting for them to subside, because once the presentation of questions begins SRRs tend for the most part to be suppressed.

The last adjustment is that of plethysmography recording. After attaching the cuff, air pressure is increased to 60-80 mmHg alternately observing the figures on the manometer and plethysmogram on recording paper. The position of the dicrotic notch is used as the reference point for the optimal plethysmogram. Adjustment is made so that the dicrotic notch is situated approximately at the middle of a wave of the amplitude of 5-20 mm. If a dicrotic notch appears in the upper part of a pulse wave, the cuff pressure is too low; if in the lower part, too high. If a plethysmogram has no dicrotic notch even after adjusting the way the cuff is applied or the cuff pressure, begin presenting questions anyway and take measurement as it is, as long as amplitudes are in an appropriate range.

14.4 Presentation of Questions

14.4.1 Observation and Interview After the Start of Question Presentation

Observation of the examinee continues even after the start of question presentation. To focus examinees' attention on questions, short interviews are given in between the presentation of question lists. At any rate, these interviews and observations aim at the acquisition of the best records that allow the making of clear decisions.

3.1.1 [sic] Intentional Disturbances by Examinees

Some examines intentionally try to cause confusion in their records. The simplest form of disturbance is an act of distorting their responses while pretending that they have occurred unintentionally. Rocking the body, yawning, coughing, or start talking while a question is asked, are examples of such acts. When instructed by the examiner "Do not move feet, hands, or fingertips," some examines, contrary to instructions, intentionally engage in the prohibited act surreptitiously behind the back of the examiner.

Examinees can intentionally disturb any of three indexes in use in the present polygraph equipment. That is, examinees attempt to disturb breathing tracings as a whole by taking a deep breath or suppressing it each time a question is presented; they also may change the breathing rhythm. SRR changes abruptly with a change in the contact area of electrodes caused by small movements of fingers where electrodes are attached, or pressing against a hard surface. Aside from these direct methods, SRR can be changed by tightening leg muscles or taking a deep breath. An increase in plethysmogram occurs when examinees move the arm where the cardio cuff is applied or tighten facial muscles.

Naturally such disturbing acts should not pass unnoticed. The examiner points out this fact and instructs, "If as you contend you have nothing to do with this crime, such actions will be disadvantageous to you."

14.4.2 Claims Concerning the Cardio Cuff

While physiological responses are being recorded, some examinees complain about the equipment; especially that pressure from the cuff is painful. While the Lafayette polygraph, expected to become the leading polygraph equipment in the future, requires a relatively low pressure (50-60 mmHg) to give clear plethysmogram, recording with the TK-1 model requires a pressure of 70-90 mmHg. As a result, after 3-4 minutes of continued recording, a tinge of numbness begins to be felt in the arm. Examinees complain about this feeling as a bodily pain.

Such examinees' complaints appear to stem from the expectation that they will affect the examiner's mentality. That is, the examiner might consider that this examinee is unusually sensitive to the cuff pressure and think it impossible to continue testing. Also, the examiner might not suspect the examinee's intentional act of disturbance: even if recordings were confused, the examiner might interpret them as due to the pain exerted by the cuff pressure, which made the examinee move his arm.

When examinees actually bring such complaints, how should they be treated? The pressure from the cardio cuff presses against the blood vessels and stems the circulation so that examinees may feel numbness in the hand after 3-4 minutes of continuous recording. However, there is no pain. Therefore, this type of claim from examinees appears to come from the psychological tension that they are in a testing

situation which makes them experience a numbness in the hand as an unpleasant pain. Aside from those examinees who complain intentionally or exaggeratedly, with others it is also necessary to shorten the time of pressurizing the cardio cuff by frequently deflating it. Most of the time examinees' understanding can generally be gained if after lowering the pressure by 2-3 mmHg the report is given that the pressure has been lowered.

14.4.3 The Start of Question Presentation

For the acquisition of records that allow the making of clear decisions, the order of question presentation must be considered.

14.4.4 Order of Presentation

The number of question lists to be presented is decided by the type of examination and the materials that have been collected for question development. However, the standard length of time between when examinees enter and leave the test room is approximately two hours, taking into consideration fatigue on the part of both examinees and examiners. Because the entire examination process must be completed during this period, the time for the presentation of questions naturally is limited. Even if abundant material for developing questions was collected, items appropriate for POT critical questions are limited. Considering these conditions, the standard is a combination of one CQT and 5-6 POT question lists.

The order of presentation is determined by concern for having the examinees' interest concentrated on the questions presented in order to obtain responses that are easy to base decisions on. One example is to enhance the examinee's interest by making the examinee grasp the central facts of the case being tested in the first presentation of the CQT list. Also, the POT lists are presented based on the assumption of the course of the criminal's behavior. Namely, with a burglary case, the POT question list begins with a critical question about where the burglar entered. POT lists that contain critical questions on the method of entry, how and where the stolen goods were kept, and characteristics about the stolen goods, follow: the list with the exit for escape comes at the end. The CQT list is presented either at the end of POT list presentation or at an appropriate time during the presentation of POT lists. For the examinee involved in the case under investigation, this order of presentation acts as a cue to vividly remind him/her about the crime, and thereby is expected to elicit responses easy to base decisions on.

14.4.5 Chart Marking

When recording of responses begins, enter the place where examines answered on the recording paper in code. For example, the code for the beginning of question presentation is "X," the end, "XX"; numbers for a manometer record are written down, e.g. 80/A, at the beginning and end of each list. As a writing tool, soft pens such as pens used for signatures are preferred, avoiding pencils which are easily

erasable and hard sounding. Examinees' affirmative answers are coded as "+," and negative as "-." Two diagonal lines are drawn at the beginning and the end of each question presentation to indicate the time for each. If the examiner has during the presentation adjusted the baseline for one of three indexes, write in "[upward arrow]" or "[downward arrow]" depending on the direction of adjustment. For responses to a sudden external noise, telephone rings, examinees' body movements, or coughing that interfered with recording, enter the event in detail, e.g. "telephone rings" or "body movements."

14.4.6 Preliminary Testing

The general method of preliminary testing is to have the examinee draw a card of his/her choice from several trump cards (number cards or letter cards may be substituted) provided. The examiner asks for every number in turn, including the one that the examinee has drawn, "Is the card you have drawn one?" and so on. The examinee always answers these questions in the negative. Relying on the responses (for the most part evaluation is based on the SRR) to each card, the examiner names the number (letter) on the card that the examinee has chosen.

The psychological effects that the procedure and results of the card test have on examinees are thought to be as follows:

- a) The test serves to make the examinee understand the procedure of

presentation of questions and the answer to them. Thereby having the effect of eliminating groundless anxiety.

b) Even while some of examinees who are hiding their crime attempt to intentionally confuse their responses to the presentation of CQT or POT question lists, as a result of the card test they will come to realize that such attempts are futile. Thereafter, their attempts at intentional control of physiological responses will cease.

c) For examinees who are not involved in the case under investigation, confidence in the effectiveness of polygraph testing will increase, thereby eliminating groundless anxiety so that results obtained in elicitation of responses become easy to evaluate.

However, one thing to keep in mind is that once the correct card is designated, a tendency to diminished responses sets in. This phenomenon is considered to be because the examinees' "resignation" lowers their alertness.

14.5 Procedures Following Question Presentation

14.5.1 Signing of the Recording Paper

The last request of the examinee is to sign the test records. Detach the part that records test results from the polygraph equipment and have the examinee sign his/her name at the beginning and end of the

paper and date it.

4.2[sic] Listening to Thinking

It is necessary to ask the examinee a question such as "Do you have any particular question that bothers you?," to find out what he/she has thought or felt regarding the test.

15. Legal Issues Regarding Polygraph Testing

15.1 Major Judicial Precedents

15.1.1 Cases to Which Article 321, Paragraph 4, of the Code of Criminal Procedure Have Been Applied

The first case in which a report of polygraph testing results was accepted as evidence to determine guilt was one for fraud and theft judged on March 5, 1959, at the Fukuchiyama Branch Court of the Kyoto Regional Court of Justice. According to the written decision, although the defendant steadfastly denied the facts of the theft, "In view of the evidence previously cited a verdict of guilt cannot be avoided." One item of evidence cited was the test report written by Eiichi Fujii and Juichi Ijiri of the Section of Criminal Identification, Criminal Division of the Kyoto Prefectural Police. However, no mention of polygraph testing was to be found in the text of the decision. Moreover, as the case itself was too trivial to attract public attention, it did not cause much repercussion as the first case in which Article 321, Paragraph 4, of the Code of Criminal Procedure was applied.

A decision was handed down at the Tokyo High Court (1) on June 30, 1966, on an appeal made on the spot that protested the court's dismissal of a request for the removal of a judge. Among the arguments in the written appeal was a section that described an

opinion regarding reports of polygraph test results. In response, the decision of the High Court explicitly stated that polygraph testing in itself did not constitute invasion of a suspect's right to refuse to make a statement, and went on to describe in detail conditions for the adoption of polygraph test results as evidence. The following statement was especially noteworthy: "When it is recognized that the above conditions are satisfied, bestowal of the power of evidence based on the Article 321, Paragraph 4 of the Criminal Code should be interpreted as legal. According to the statement of Mr. Yasushi Nihei, the witness who appeared previously, in the present case these two reports of polygraph testing did not necessarily fail to fulfill the above conditions." This case was thus the first one to apply Article 321, Paragraph 4 at a high court level.

Reference: Article 321 of the Code of Criminal Procedures

(omitted text)

- 3 A document conveying test results, when verified by prosecutors, officials of the prosecuting office, or staff of the judicial police, can be used as evidence, provided that the person who prepared it is duly examined as witness on the date of the trial and the said person confirms that it was truly prepared by himself/herself, the provisions of Paragraph One notwithstanding.

- 4 The above provisions hold true for a document about the process and results of an examination by experts and prepared by expert witnesses.

15.1.2 Case of Rejection

One decision in 1960 further clarified the validity of polygraph test results as evidence. Unlike the case at the Fukuchiyama Branch Court of the Kyoto Regional Court of Justice, this case (2) was introduced as an example of rejection of polygraph test results as untrustworthy. On July 20, 1960, a decision of 'not guilty' was handed down in a case of theft/arson at the Tokyo Regional Court of Justice. The main point of dispute in this case was the reliability of the defendant's confession. As to the power of reports on polygraph test results as evidence, the decision states the following: "According to the statement of Yoshizumi Niimi, examiner, made in this court, and according to his report and another report prepared by Yoshimasa Imamura, another examiner, the following conditions must be met to guarantee the reliability of polygraph test results: the examinee must be clearly aware; his physical as well as mental condition must be sound; the methods of development of the questionnaire as well as the questioning itself must be reasonable; examiners must possess specialized basic knowledge and training; and testing must take place where no other influences or stimuli, save for the questions as stimuli, are present. In addition, some other conditions must be

fully met. It is considered almost impossible for another specialist to evaluate the reliability of decision after the fact, based only on the polygraph test records by themselves, unless it is known exactly under what conditions testing took place. Therefore, polygraph test results, the accuracy of which is almost impossible to be guaranteed, cannot be used as evidence attesting to the reliability of the defendant's statement." This view on the capability and power of reports about polygraph test results as evidence gives the impression that one step backward has been taken.

15.1.3 Notification of Test Results and Confession

A question was clarified about possible absence of voluntariness in examinee confessions made after notification of polygraph test results. On June 1, 1964, the Second Court of the Supreme Court handed down its decision (3) to the effect that confessions made after the investigator in charge notified the examinee about test results did not necessarily lack voluntariness. The criminal facts in the case were as follows: the defendant, a farmer's wife, became indignant at the cool attitude of her lover of 10 years and she planned out of revenge to burn down the lover's house. However, to avoid casting suspicion on herself, she set fire to the house of her lover's neighbor counting on the fire to spread. However, contrary to the defendant's expectations, the revenge failed because the fire did not spread to her lover's house. She then wanted to vent her grudge by at least beating the lover. Instead, she managed to hit his wife in

the head by mistake, thereby injuring her. The first trial recognized these facts and found the defendant guilty. Although the defense attorney[s] appealed the verdict, the appeals court rejected the appeal. The defense attorney[s] then further appealed, contending that: "The defendant is a housewife who has never been investigated by the police, a polygraph test was given without the existence of corroborating evidence other than village rumors. Under such circumstances, notification of results as being 'black' imposes psychological constraints on the defendant. This comprises 'coercion' as defined in Article 38 of the Constitution. Therefore, the decisions regarding the original and first appeal, in a case in which a defendant's coerced confession was admitted as evidence, are unconstitutional." To this contention of unconstitutionality, the Supreme Court responded that no evidence of coercion on the part of the chief investigator to obtain the defendant's confession was recognized. Therefore, the premise for the argument was lacking and the appeal was rejected on the ground that the appeals law did not apply to the point of the defense's argument. In regard to the notification of polygraph test results, the decision stated: "A polygraph test was administered by specialists to a consenting defendant who had at first denied the crime. After that, the chief investigator notified her of the polygraph findings and requested her to tell the truth. The defendant remained silent for a while and then made a complete confession, requesting that it be kept secret from those involved in the case. So, there is no evidence that the investigator coerced a confession nor any reason to question the

voluntary character of the confession."

15.1.4 Power of Evidence of a Report of Polygraph Test Results That Conform to Article 326, Paragraph 1, of the Criminal Code

On February 8, 1968, the Supreme Court handed down a decision to the effect that a report of polygraph test results that conforms to Article 326, Paragraph 1, of the Criminal Code possesses power of evidence when the results are reliable as regards to examiners' techniques and experience, as well as the efficiency of the testing equipment (4). In this case, the defendant was indicted on charges of theft, forgery and improper use of a private document, and fraud. The defendant was accused of swindling cash from a post office, after stealing a fixed sum postal savings certificate issued in someone else's name and forging a receipt.

The decision of the appeals court ruled that "Because the report on test results appear to be reliable; there is no obstacle to recognizing the document as evidence, based on the situation in which each document was prepared."

The gist of defense lawyer's appeal that referred to polygraph testing stated, "While polygraph testing technology is being developed, theoretically it is still quite imperfect. To recognize its results as evidence for the reliability of defendant's statements is tantamount to invasion of the defendant's civil rights and, therefore,

should be considered to be a very dangerous practice."

The Supreme Court's response to this was, "While there must be concern about to the use of polygraph test results as evidence for the reliability of defendant's statements, it is justifiable that the original court recognized the two reports of polygraph test results as having the power of evidence in accordance with the provisions of Article 326, Paragraph 1 of the Criminal Code."

15.2 Power of Evidence

15.2.1 Relevancy as an Important Premise

Judge Yamazaki and others stated that "to recognize polygraph test results as having power of evidence, their relevance must be demonstrated through possession of a minimum power of proof with regard to the facts to be established (5)." Necessary conditions for relevance include: 1) accuracy of the test results, 2) proper maintenance of testing equipment, and 3) competence of the examiners. As to the first, accuracy of test results, the level of achievement attained by actual tests administered in our country attest to such accuracy without resorting to data available in foreign countries, e.g. data presented by Inbau etc. For example, a 1971 report by Tamao Hitta of the Nara Prefectural Police Head Office (6), is a survey of tests given to a total of 1,889 persons over the seven year period from 1964 to 1970. Out of this number, 1,063 (56.3 percent) of the

examinees were evaluated as positive, 748 (39.6 percent) as negative, and 78 (4.1 percent) inconclusive. Among these, cases solved through physical or other evidence gathered through investigative as well as evaluating activities served as criteria in the assessment of the results of polygraph evaluation. Decisions were confirmed in 932 (87.7 percent) out of 1,063 cases evaluated as positive and 234 (31.1 percent) of 748 evaluated as negative. Concordance between solved cases and evaluation through polygraph test results was present in 928 (99.5 percent) of the 932 cases judged to be positive, and 215 (92.2 percent) of the 234 judged to be negative.

The results of a survey by Yasushi Nihei and Shigeyuki Tateno of the Ibaraki Prefectural Police Head Office involving data on 925 people tested over the eight years between 1973 and 1980, reported in 1983 (7), evaluated results of polygraph tests in 569 (61.5 percent) as positive, 308 (33.3 percent) as negative, and 48 (5.2 percent) as inconclusive. Cases tested were checked against the resolutions of cases. Criteria for the correlation followed those adopted in the report by Tamao Hitta of the Nara Prefectural Police Head Office. Namely, a positive evaluation of a case was considered to have agreed with the solved case when the examinee admitted to the crime and his/her statements were supported by physical or other evidences. And a negative evaluation was considered to have agreed with the case resolution when a person other than the examinee admitted to have committed the crime and this statement was supported by physical or other evidence. In this survey, confirmed number of cases solved were

491 (86.3 percent) of 569 cases solved judged to be positive, and 172 (55.8 percent) of 308 cases judged to be negative. Concordance of solved cases with the outcome of evaluations on test results are reported as follows. All the cases, 491, evaluated as positive agreed with solved cases. Out of 172 evaluated as negative, 170 (98.8 percent) agreed. Theoretical questions are presented in psychophysiological studies on conditions relating to accuracy of polygraph testing carried out in Japan as well as in foreign countries. As it can be fully expected that in the future the proximity of actual test results and theoretical studies will steadily improve, this problem can be regarded as almost solved. As to the second issue about testing equipment, systematic research results that followed studies initiated by the Indiana University group (Elson and others) on measurement indexes have contributed to the improvement of equipment. The equipment used in actual testing has been changing: starting with the psychogalvanometer, the imported Keeler polygraph, KK-TRP, KT-I models and introduction of the KT-II model manufactured by Takei; and now the recent Lafayette polygraph. Further improvements can be expected in the future. As to the third issue of examiner qualifications, graduation from a psychology department at college level or possession of an equivalent background is required to be enrolled in the Training Department of the Inservice Jurisprudence Training Institute of the National Research Institute of Police Science. This course work is required to start a job as an actual examiner. Further, examiners' testing skills are expected to improve through attendance at conferences on examination technology in

parallel with accumulating practical experience.

As described above then, in view of what has been accomplished up to today, the issue of relevancy has been well addressed.

15.2.2 Hearsay

As regards hearsay, the legal theory issue is outside our competence, but jurists' opinions are introduced below: judgements by judges Yamazaki and Naito address the issue of hearsay (5) thus: "Hearsay concerns statements made on a specific date other than on the day of trial, based on test results obtained by an examiner and on an opinion regarding them arrived at by him." They go on to opine that such accounts are prepared by the examiner himself/herself soon after testing while the examiner's memory is fresh (in many cases referring to memos taken during the test itself) and accurately states the testing processes and results. Such accounts contain details which are difficult to retain for a long time, e.g. many relevant questions and answers to them, evaluation as to truth/falsity for each answer, facts encountered in the course of testing that served as basis for forming the examiner's opinion. In fact such accounts are no different from documents prepared by an expert witness stating the process of examination and its results (5)." Therefore, the prohibition of hearsay as defined in Article 320, Paragraph 1 of the Criminal Code, "With the exception of cases defined in Article 321 and 328, documents such as substitutes for statements made on the trial

date, or statements that contain statements of others made on a date other than the trial day, cannot be used as evidence" is in this case removed, provided that the following procedure is followed: Examiners are required to attend the trial and be available for questioning as witnesses and stipulate that the report submitted is the one genuinely prepared.

Section 3 [sic] Bearing on the Right to Remain Silent

There are two theories concerning the status of polygraph test results with regard to the right to remain silent: the theory of nontestimony evidence and testimony evidence. These two theories, offering contrasting positions, both assume examinee consent (agreement) which does not make much difference in actual testing (8). In current polygraph testing procedures, examinee consent is obtained in the form of a letter. And if no consent is obtained, no testing is compelled. Therefore, the issue of the right to be silent has been resolved. While the three conditions that bestow power of evidence to polygraph test results have for the present been met, as seen above, we should continue to try to strengthen the power of evidence through further improvements in the conditions required for relevancy.

15.3 Evidentiary Authority

15.3.1

In his theoretical opinion, Judge Hangai [or Hangaya or Hanya: not confirmed] discusses Supreme Court decision (1967 "a," 2188) as a concrete example of the evidentiary authority of polygraphy test result reports, "The nature and extent of the matter require clearer criteria that can withstand practical application through the collection of more case examples (9)." After remarking that it might be redundant to so note, the judge touches on the issue of evidentiary authority, stating that "once their evidentiary authority is recognized, reports on polygraph test results face even greater, real difficulties in evaluating the practical application of their evidentiary authority than in establishing their evidentiary authority (9)." Further, affirmation of evidentiary authority as matter of general theory and evaluation of evidentiary authority in an individual case are different issues. The judge emphasizes the need for vigorous evaluation of the evidentiary authority of reports of polygraph test results presented at individual cases brought to trial. Needless to say, the evidentiary authority represents the practical value of the proof. In Article 318 of the Criminal Code it is clearly stated that "the evidentiary authority of proof is entrusted to the free interpretation of a judge." So, a judge can exercise free judgment in forming his/her own opinion.

15.3.2 A Case Judged as Having a Low Power of Proof

Problems will be discussed here in regard to a case of a polygraph test report that was judged to possess low evidentiary authority even

though its evidentiary authority had been generally recognized. This was a case of forced indecency, invasion of a private residence and rape with bodily injury. In the first trial, the defendant was found not guilty of forced indecency, but guilty of invasion of a private residence. No prosecutorial appeal was entered for forced indecency so that the acquittal became final. The report on polygraph test results presented, admitted as evidence in the first trial, was evaluated as possessing "a rather high degree evidentiary authority." In the appeal, however, the following conclusions were delivered: "Although the defendant confessed to the crime at the investigatory stage, because some irrationalities as well as unnatural points appear in the contents of the confession, it is not necessarily considered to be highly reliable. Although the result of odor discrimination by a police dog of a sandal left at the scene of the crime appears to be trustworthy to some extent, there is still some doubt about its total reliability. In addition, the evidentiary authority of results of a polygraph test given to the defendant must, on the other hand, be deemed quite low. The evidence taken together is, on the whole, insufficient to establish the defendant's guilt." So, the first trial recognized the evidentiary authority of polygraph testing to be "rather high," but on appeal it was determined that "it must be called quite low." This difference is a substantial one. Because it appears to be useful to examine the grounds for this reasoning, we will study the contents of the appeal court's decision in more detail. The decision relating to the evidentiary authority of polygraph test results went as follows: "Because at present results of polygraph

testing are generally recognized to have a rather high degree of accuracy; it is appropriate to examine the report that states the test process and results, to determine the presence or absence of the evidentiary authority based on Article 321, Paragraph 4 of the criminal code on 'expert opinion in writing.' Concerning the polygraph test in this case, there obviously is no illegal procedure such as invasion of the right to silence. It is also recognized that conditions that guarantee accuracy in the test (examiners' knowledge, techniques, and experience; equipment capabilities; and examinee's physical and mental conditions) have been satisfied; therefore, the report in which the examiner has stated the test processes and results "should be recognized as having evidentiary authority (10):"

Moreover, the defendant's contentions that (a) the right to remain silent had been infringed, (b) inappropriate mental as well as physical conditions had been imposed on the examinee at the time of testing, and (c) that questionnaire development had been irrational were rejected after each point had been deliberated. However, the evaluation of the evidentiary authority of polygraph results was severe. First regarding questionnaire development and method of presentation, "Because of inappropriate question development, responses to some of the eight questions that were evaluated as positive cannot be accepted as they are (10)." Regarding measurement indexes, "Among responses to stimuli (questions) which were seen as positive, some are positive only in terms of SRR, an index that has been criticized as relatively unreliable." Adding to this opinion,

"taking these points into consideration, the evidentiary authority of polygraph testing must be called quite low."

So, in concrete examples of evaluation of evidentiary authority, there have been problems with questionnaire development and indexes used in measurement. The first problem lay with the fact that the contents of critical questions on POT lists also appeared as contents in relevant questions on CQT lists.

Generally, one of the points to which attention must be paid in developing questionnaires, the lack of independence between the contents of different questions, certainly poses an important problem. Let us study it, using a simplified hypothetical example. Let us assume that a case of theft of a black leather wallet with cash in it is object of the test. First, a question list regarding the article that contained the cash is to be developed. It goes without saying that the critical item here would be the "wallet." After the presentation of this list, the examinee is told that "Actually, it was a 'wallet' that contained the cash. Next, from questions about the 'color' of the wallet," go on to present the list that contains the critical item "black," the wallet's actual color. This procedure, presenting the list in the order, "the container of the cash (wallet)" --> "wallet (color)," might appear to pose no problem. However, unless the order of presentation has been recorded on videotape, it is difficult to prove it to a third party. A possibility exists that the examinee might claim later that "during testing, the examinee, who did

not know before testing that the cash was in a leather wallet, came to learn that fact from the examiner: therefore, it was natural for him to respond positively to a question about the wallet." In the mind of a third party who does not have detailed knowledge of testing techniques, such a contention might arouse some doubts about the appropriateness of the test procedures.

A Case of a Suspected Leak of the Contents of a Critical Question Prior to Testing

In this example a possibility was raised that prior to testing the examinee had an opportunity to find out the contents of critical items. If such a possibility did in fact exist, the effectiveness of the POT would be called into question. Referring to POT test results that included, in addition to other critical items, allusion to a pharmacy from which the suspect in an attempted murder case by poison might have made a purchase, the decision read as follows: "By contrast to other evidence, an especially cautious attitude is required in evaluation of the said report and the determination of its degree of credibility. If the investigative staff, while taking statements or checking the situation between the time since 8:15 a.m. on February 2 of the same year when the defendant was asked to accompany [the investigators] voluntarily and prior to testing, provided a chance, for the defendant to guess or directly or indirectly find out the facts about the said XX Pharmacy, it is anticipated that responses similar to those described in the said

report would appear. It has not established that such a circumstance did not exist in this case ("wa [a letter in the Japanese phonetic list]," no. 4', The Kanazawa Regional Court, 1981). According to the text of the decision, a probability existed that contents of the critical question in a POT questionnaire were known to the defendant before testing. As long as such a probability could not be excluded, the credibility of the POT was determined to be low. Therefore, lest this type of problem arise, careful consideration in question formulation is essential. Concrete precautionary measures are necessary, e.g. clear writing of the expert evidence (report on test results), including information about such test procedures as pretest interview or reading of question lists to defendants.

Problems with Measurement Indexes

Some hold the opinion that SRR is less effective than the other two measurement indexes used in polygraphy. The first jurist to state this opinion was Judge Yamazaki. In one article, he explains polygraph equipment in the following way: "Although modified and improved, the structural principle of polygraph equipment manufactured and currently in use in investigations in Japan is the same as that of the Keeler Polygraph adopted by police in the United States. It consists of three pieces of equipment, a device for recording respiratory movements, one for heart beats, and a third for SRR. Because the last type of recorder is not very effective in practice, the first two are the ones that are principally used (5)." We find it

difficult to understand the grounds for this view. Inferring from the date of this paper, his view could have been influenced by a passage in Inbau's Lie Detection and Criminal Interrogation, 2nd edition (1948): "Electrodermal responses cannot be regarded to be of much practical value as criteria for the detection of lies." In the background of Inbau's expression were problems inherent in the testing equipment of that time. The electrodermal response measuring device, the so-called Keeler Polygraph, employed a bridge circuit that measured skin resistance without filtering them through a time constant. In addition, with that device switching of resistors in keeping with changes in skin resistance was structurally difficult. In short, the Keeler measuring device was quite a simple one when viewed from today's technical level, so that it is easy to imagine that with that equipment measuring and recording changes in skin resistance in response to stimuli must have been difficult. Because the testing devices used by Inbau and Reid must have been at a similarly primitive level, it is understandable that the value of SRR as a measurement index was evaluated as relatively low. Later, in a book Inbau coauthored with Reid (13), the statement regarding the low value of the SRR disappeared, being replaced by reference to an article by Slowik and Buckley (14). The latter gave the survey results evaluating each measurement index, respiration curve, SRR, and plethysmogram. Seven expert polygraphers evaluated 30 testing records, all of which were later confirmed to be correct. Each evaluator was given records with the individual indexes separated. The results showed that little difference existed between the three

types of indexes when used as evaluating criteria. A characteristic of SRR, compared to other two, is that it is more sensitive to stimuli. This characteristic cannot be considered to be as an adverse factor for use as a measurement index in the context of polygraph testing. Experience has shown that in some cases and depending on existing conditions, the SRR can be the most effective measurement index. Therefore, the judge's evaluation that the SRR is less effective than the other two indexes is difficult to accept. Also noteworthy here is another problem that relates to a measurement index. The case in point is one in which, out of three indexes, an imperfect cardio recording resulted in the invalidation of an entire test record, resulting in the view that the polygraph's evidentiary authority is low. The case was one of suspected theft, for which a verdict of guilty had been handed down in a first trial. The following is from the text of the decision that referred to polygraph testing and its results. "The witness is a highly-reliable technical expert with 17 years of experience with polygraph testing. The test was administered in an investigative chamber at the XX Police Station; the equipment used was a new KT1 model. Before the testing, precautions were taken to eliminate factors that might adversely influence the defendant's emotional state and to create a stable state by prohibiting the coming and going of police staff, other than the examiner and one assistant; by adjusting room temperature; and by providing cigarettes at the defendant's request. It was clear that the defendant gave voluntary consent at the beginning of the testing. The document is recognized as faithfully rendering the course of the

defendant's emotional responses as well as the test results." The court also recognized that, based on the testimony of the witness, the "polygraph testing as performed by the witness had high accuracy, over 99 %." The court accepted this report of polygraph test results as part of the evidence. Nevertheless, the Appeals Court's decision was "not guilty." The decision's text addressed the issue of polygraph testing. First, regarding the evidentiary authority of the report of the polygraph test results, "(According to the witness' testimony in the original trial) in view of the examiner's technical experience as well as the performance of the equipment used in the test, it is generally reliable. The report on polygraph test results is recognized as faithfully stating the results of the said polygraph testing. Therefore, the report is considered to possess evidentiary authority, the original decision having held the same view, and is not in violation of the law on judicial procedure." However, a negative opinion was formed regarding evidentiary authority "Regarding the report on polygraph testing cited in the original decision, its evidentiary authority is recognized, as discussed previously in I. In this report, in the place underlined, it is stated that electric resistance measurements on the skin and blood pressure and cardio responses are unclear. The witness in the original trial, XX XX, stated that measurements were taken from above layers of clothes that the defendant was wearing and therefore failed to obtain clearly evaluable results. The witness stated that the an evaluation was nevertheless made on the basis of skin and respiratory responses, admitting on his own that the test did not yield completely

satisfactory results. Moreover, to begin with polygraph testing evaluates only the defendant's answers to true/false questions posed by the examiner. Its results should not ever be considered as having directly proved the defendant's guilt. They are, at best, material of a nature to enhance the credibility of a defendant's confession, material for evaluating a denial as a falsehood, or material for recognizing the existence of feelings of guilt. The report contains occasions of positive responses to questions about criminal facts targeted in the trial. However, the defendant might have known these facts before testing and that knowledge might have caused him respond positively. Therefore, the evidence in question could not be taken as material that establishes his guilt ("u" [a letter in the Japanese phonetic list], no. 1198, the Osaka Supreme Court, 1977)." It is certainly extremely difficult to obtain an understanding of the relationship between constancy and specificity in the mechanism that elicits physiological responses. Through continued efforts to present concrete examples, the prospect for gaining such an understanding can gradually improve. In addition, we should strive to improve the conditions of test procedures, conditions that might reduce the reliability of test results, while at the same time trying to present abundant material that will contribute to public understanding of this testing methodology.

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